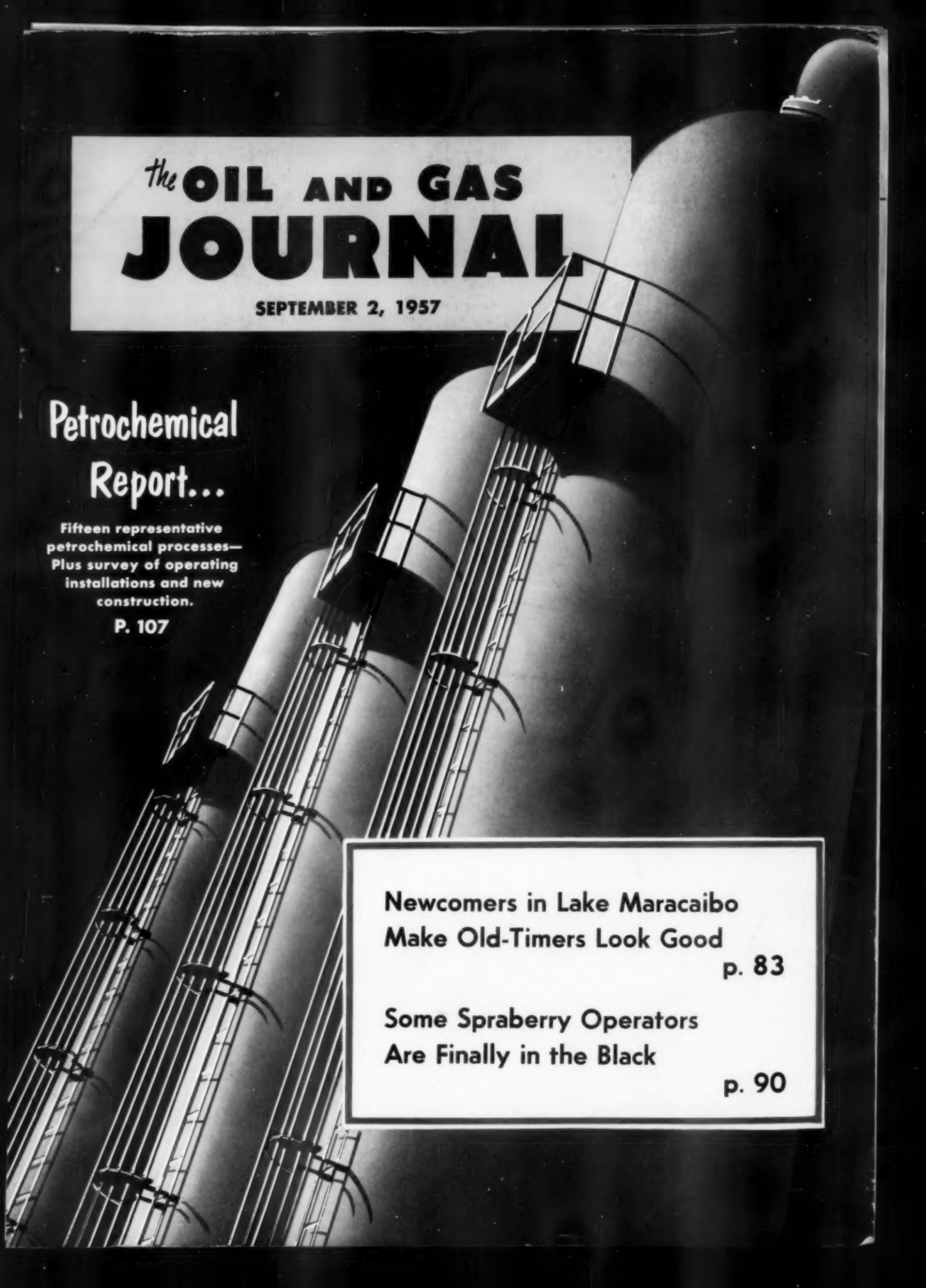
the OIL AND GAS JOURNAL

SEPTEMBER 2, 1957



Petrochemical Report...

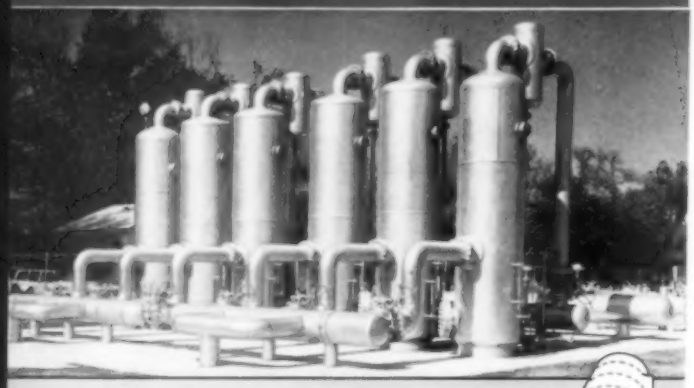
Fifteen representative petrochemical processes—Plus survey of operating installations and new construction.

P. 107

Newcomers in Lake Maracaibo Make Old-Timers Look Good p. 83

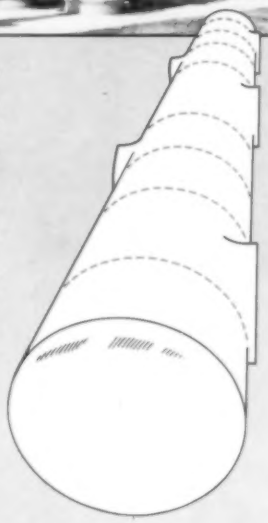
Some Spraberry Operators Are Finally in the Black p. 90

How Oklahoma Natural compounded savings by specifying cold extrusion



Oklahoma Natural Gas Company compounded installation savings at their South River Station, Tulsa, by (1) designing for multiple outlet headers and, (2) specifying Fluor-formed headers with cold extruded outlets.

The diagram at the right shows how each of the four 20″ O.D. headers at the South River Station eliminated five 20″ × 20″ × 12″ reducing outlet tees and eight 20″ welds (indicated by broken lines on diagram)—a total saving of 20 tees and 32 welds!



By specifying Fluor-formed headers with cold-extruded nozzle outlets, these added savings were realized

1. IMPROVED STRENGTH & DURABILITY – Polished extrusion dies impart a smooth, dense surface finish to the outlet—assurance of longer service life where vibration or pulsation stresses are involved.

2. CLOSER DIMENSIONAL TOLERANCES – Flowing steel under compression while in a tough stable condition permits extremely close tolerance dimensional configurations—center-to-center and centerline location tolerances are easily held within .060″.

3. LESS MATERIAL NEEDED – Fluor-formed cold extruded multiple outlet headers need no extra length for manufacture—they are made to the exact length and wall thickness required.

4. NO DELAYS – Because nozzle outlets are cold extruded, headers are often made from stock or from the same pipe used elsewhere in a job—production is faster, inspection is simpler.

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JOURNAL News Letter

Sept. 2, 1957
Tulsa, Okla.

Failure of gasoline demand to reach expectations is puzzling:

Increase of demand for the first quarter was 3.8 per cent. Second quarter saw no increase. This makes volume of gasoline used in first half of 1957 only 1.8 per cent above last year. Most forecasts called for normal increase of about 4.5 per cent.

Economists cite these possible explanations:

Failure of highway building to get started quickly; lack of parking facilities to match auto traffic; drop in farm and highway truck use; cutbacks by the military; and changing attitude of American public toward use of automobiles.

The changing attitude is believed important.

Pleasure driving is beginning to disappear as a big factor in use of the family car. Most families, especially two-car families, regard the car as a vehicle of short-range every-day transportation. This may explain why seasonal swings in gasoline demand are less pronounced.

These factors tend to hold down mileage driven per car. That offsets to some extent the effect on gasoline demand from growing number of cars on road.

Sagging tanker rates may get another above downward if imports drop significantly under the voluntary control plan.

The proposed reduction in imports will release the equivalent of 60 foreign-flag T-2 tankers. This is offset some because the expected increase in oil shipments from the Gulf Coast to the East Coast may require some 20 American-flag T-2 ships.

Tanker owners already are in trouble from low rates.

A foreign-flag tanker hauling 15,500 tons of oil from the Caribbean to the American East Coast needs a rate of about $1.90 a ton to break even. Current rate is $1.21. An American flag tanker running from the Gulf Coast to the East Coast needs about $2.70 to break even. The going rate now is $1.65.

Ship owners are taking on cargoes at a heavy loss to avoid even more costly layups. And they face more rough sailing. New tankers are coming off the ways at a record clip to compete for business. Some 99 vessels totaling 2,712,785 tons have been completed in the first

6 months of 1957. Even more will be completed in the second half.

If you think the oil industry isn't under the gun, consider this: One out of every four lawyers in the antitrust division of the Justice Department is working on oil probes or suits involving oil.

Assistant Attorney General Victor R. Hansen says these suits include a series of exclusive dealing cases. The department hopes the law will be settled as to just what types of contracts between filling stations and suppliers are illegally restrictive.

Justice Department lawyers also are working on a report on the Interstate Oil Compact due within a few weeks. The first report was made last September. Hansen says through the reports Congress will be able to make new laws removing the anticompetitive factors in the oil industry.

American oil investments abroad have reached $7.2 billion. They're increasing this year at about the same rate as 1956 when $1.4 billion was spent by U. S. interests in Latin American concessions, Canadian pipelines, and refineries in Europe and elsewhere.

Latest Commerce Department figures give this breakdown of the 1956 foreign investment: $400 million in Canada, about the same in Latin America, $200 million in Western Europe, and $400 million in other areas.

Humble has managed to commit 400 million cubic feet daily of its vast gas reserves--and all of it is for intrastate use.

That's enough gas to supply a big transmission line running from Texas to New York. But the gas will be used within Texas alone.

Humble long has refrained from marketing gas under FPC regulations. By unloading the gas within Texas, everyone connected with the sale will escape FPC rules. Price to the producer also should be good, especially since transmission costs will be nominal.

The gas will come from a new 750 million cubic foot daily processing and cycling plant Humble plans in Kleberg County. The site is 15 miles southwest of Kingsville and will process gas from Humble's big King Ranch lease. The gas will move from the plant to Houston area through a 250-mile, 26-in. pipeline.

Customers for this big slug of gas have not been revealed. Logical guess: Big petrochemical plants and Texas utilities. And don't overlook the possibility that Humble might enter petrochemicals for first time and use part of the supply itself.

Big chunks of Louisiana Gulf Coast gas, meanwhile are bringing premium prices.

Important victory of the C.A.T.C. group in making its 21.4-cent contract with Tennessee Gas stand up before FPC has set the pattern. New Texas Eastern has agreed to pay 22.6 cents per M.c.f. and Southern Natural only last week settled on 21.5 cents. These prices will

become an issue when the projects are considered by the FPC.

Feasibility study for that much-talked crude line out of Williston basin of North Dakota and Montana has been completed.

And the backer--Great Northern Railway--is now working to get producers and refiners together to firm up the market and supply.

Initial plans call for 12-in, 20,000-bbl. daily line to the St. Paul-Minneapolis area.

The steady rise in earnings of gas pipelines has been reversed. The 37 major systems regulated by the FPC experienced a 4.8 per cent drop in earnings for June compared with the same month last year. For the year ended in June, net income was off 1.9 per cent.

Operating revenues are at new highs--$2,229 million against $2,015 million last year. But costs have gone up even higher. Cost of gas is up 16.7 per cent. Transmission costs also are up 12.8 per cent.

These explain why pipeline profits failed to rise for the first time since World War II. In fact net income dropped from $236.4 million to $231.9 million for the year.

Independent refiners are burned up by the plan being proposed by Defense Department for its cutback in military oil purchases.

Defense wants to jam most of the $115-170 million cut into the last 5 months of this year. Refiners want the cuts spread over the 10 months left in the fiscal year.

Refiners claim the speedy cutback will cut oil stocks held by military units to dangerous levels and leave refiners with money tied up in stored products.

Refining notes: The boom glamor may be gone from petrochemicals. But there's still room for plenty of growth and profits, a Harvard research study reports (p. 94)... The much discussed push-button refinery gets closer. Next year a new digital computer will be incorporated into the control setup of a refining process. It's being designed for automatic control or refinery and petrochemical processes (p. 151)... Refinery construction costs continue to edge upward. Latest Nelson Index hit 203.6 compared with 100 in 1946. This is up 1.6 from the month before and 8.3 from 1956 (p. 146)... Sale of Universal Oil Products Co. has hit another snag. Referee Louis M. Loeb has recommended that New York Supreme Court refuse to approve sale.

Colorado's oil-shale reserves are much greater than thought. The U. S. Bureau of Mines now says they contain 1-1/2 trillion barrels of oil. This is 50 per cent greater than an earlier federal appraisal.

Reason for the increase: Some oil-shale beds are much thicker than at first estimated. One area where beds were believed 150 and 200 ft. thick actually proved 1,500 to 2,000 ft. thick.

It's too early to tell how American oil men are making out on their $400 million bet on Lake Maracaibo acreage in Venezuela.

Several newcomers have made good strikes in the lake.

Others haven't begun to drill on their concessions.

The uncanny fact about the strikes of newcomers thus far: They all have enhanced nearby acreage held by veteran firms in Venezuela (p. 83).

Some of the biggest plungers in the early Spraberry Trend drilling boom finally are showing a profit on their investments.

Sohio and Magnolia reportedly are among those now edging into the black on their Spraberry production. These and other operators still in the red on their wells look to future developments which might push their profits out of the marginal class.

The development is one of the production surprises of the year and lifts some of the gloom that has pervaded the big Texas field since its bubble burst in 1952 (p. 90).

Magnolia is having an unusual problem at its 1 Sterba deep wildcat in Cement field of Caddo County, Okla.

The drill is heading below 20,000 ft. But because of the allowed drift, bottom of the hole is about to move off the 160-acre lease.

To avoid trouble, Magnolia has whipped up an agreement with two adjoining lessees to form a drilling unit. Company also is seeking a 640-acre spacing rule for the unit from Oklahoma Corporation Commission.

Pure Oil's successful wildcat in Paradox basin points out the tremendous untouched potentials of Mississippian rocks in the basin's northern section.

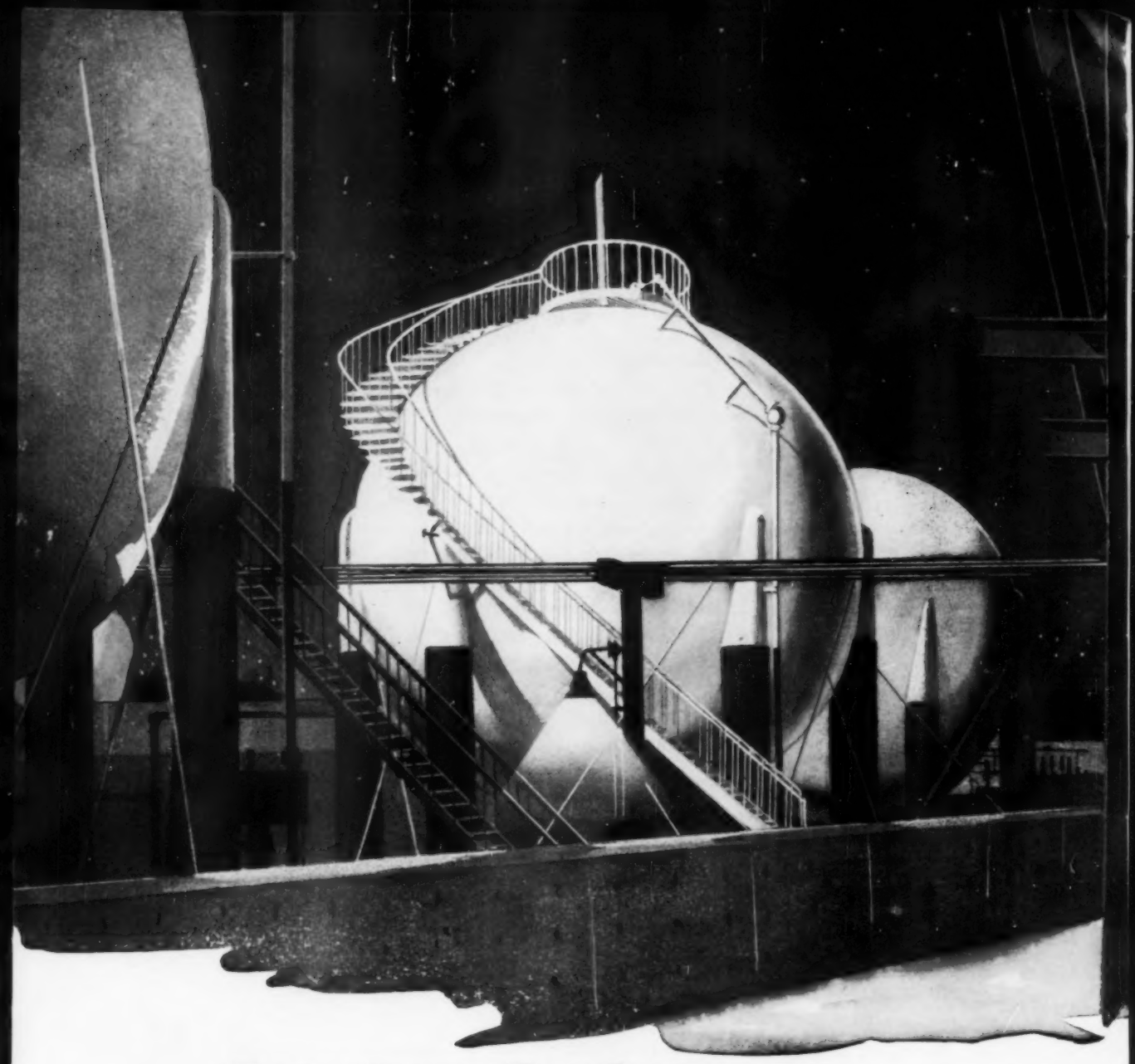
Pure got an oil flow of 319 bbl. of 43.3°-gravity crude in 24 hours at its 1 Big Flat Unit 9 miles north of Four Corners' Aneth trend. Production was from Mississippian lime at 7,694-723 ft. The closest current Mississippian production is in Wyoming.

Foreign exploration: El Oriente has completed first stepout to its discovery in Peru's Amazon basin. The 2 Maquina flowed 270 bbl. daily from 2,150 ft... Aramco is moving eastward from its flush producing field in Saudi Arabia for a deep wildcat test of the Dahana area... Stanvac's first test on a 10,000 sq. mile concession in India's Bengal basin has been abandoned... California Ecuador Petroleum has important shows below 2,000 ft. in its 1 Santo Domingo wildcat in Ecuador... Italian Government oil outfit apparently has sewed up an exploration deal in Iran and now is seeking oil rights in Syria, Jordan, and Yeman.

That 15-cent cut in the price of Michigan crude will stick.

But there are no signs it will spread to other areas.

Carter, a large producer in Michigan, gave in after it could find no other buyers when Leonard posted the lower price.



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IN THE NEWS

General Interest:

Canadian Oil Men Seek Relief From Taxes ... 84
Salvage Crews Cut Up "Mr. Gus" for Towing to Shore ... 85
O'Mahoney Demands New Oil Investigations ... 86
Foote Refuses to Sell Stock to Get Government Post ... 87
Socal Computer Will Solve Down-to-Earth Problems ... 96
Imports-Control Hearings Start Next Week ... 98
Independent Gas Producers Challenge FPC Jurisdiction ... 99

Drilling and Exploration:

Newcomers Take Drilling Plunge in Lake Maracaibo ... 83
Colorado Oil-Shale Reserves Set at 1½ Trillion Barrels ... 85
Standard of Texas Taps Deep Sediments in Pecos ... 99
Four Corners Test Hits 90 Miles North of Aneth Trend ... 100
Italy Making New Deals in Middle East ... 102
Drilling Barge Making 6,800-Mile Trip to Persian Gulf ... 103
Aramco Spuds Rank Wildcat in Saudi Arabia Desert ... 104
Stepout Completed to Peru's Amazon Basin Discovery ... 104
France's Aquitaine Basin Yields New Strike ... 106
Report on Sunshine's Washington Well ... 215
Cambrian, Ordovician Oil Possibilities in Indiana ... 216
Wildcat Fever Breaks Out in Williston Basin ... 219

Processing:

Processing Briefs ... 89
More Stability Ahead for Petrochemicals ... 94
Sale of U.O.P. Opposed by Court Referee ... 98
Independent Refiners Protest Military Cutback ... 99
Big Stocks Force West Coast Refining Cutback ... 100

Pipelining:

Shell Sells Big Gas Supply to Canada-San Francisco Line ... 92
Pipeline Briefs ... 101
Work Starting on Four Corners-New Mexico Crude Line ... 101
Pauley Forms Company to Build Mexico-to-Cuba Gas Line ... 104
Tooling Up Starts for 28-in. Crude Line in Germany ... 106

Production:

Carbonated Water Adds Some New Twists to Flooding ... 88
Spraberry Trend Finally Pays Off—for Some ... 90
Texas Changes Signals, Phillips' Permanent L.A.C.T. First ... 95

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TECHNOLOGY–OPERATION

Special Process Section 107

Here are flow sheets and flow descriptions of 15 selected processes used in making chemicals and chemical intermediates from petroleum. These are the major petrochemical processes in use today. They include the manufacture of ethylene, acetylene, butadiene, oxidation products of butane and propane, aromatics, specialty polymers of propylene, ammonia, sulfur, and carbon black.

Survey of Plants, New Construction 124

This table covers plants, existing plants, and their products. Because of a recently completed extensive Journal survey, these listings are completely up-to-date and thoroughly accurate. The survey is divided into six tables for convenience and fast reference: 1—Organic chemicals; 2—Ammonia and nitrogen products; 3—Butadiene and synthetic rubber; 4—Sulfur-conversion plants; 5—Carbon black; and 6—Canadian petrochemical plants.

Refining-Processing

Nelson's Refinery Cost Index 146

New Digital Computer for Process Control 151

By D. H. Stormont

A new digital control computer, specially designed for automatic control of refinery and petrochemical processes, is scheduled to be incorporated into the control setup of a refinery process during the next year. It can be connected directly to process instruments and control devices.

On The Job . . . In The Plants 163

Portable cleaner speeds cat cracker turnaround. A large vacuum cleaner is being used by The Texas Co. at its Port Arthur, Tex., refinery to remove residual catalyst from fluid cat crackers during turnaround. The cleaner is portable and it can be attached to a permanent vacuum line on the unit at any one of several outlets.

COST-imating 164

Drilling-Production

Aluminum Derricks for Lighter Loads, Lower Costs 144

By F. F. Dietsch and D. V. Wilcox

Several rigs recently put into service show that aluminum can be used successfully to lighten the load while maintaining strength. Over-all rig weight is reduced about 15 per cent.

How Rock and Fluid Properties Affect Flow in the Reservoir 153

By F. E. Merliss, J. D. Doane, and M. J. Rzasa

A study of two-phase fluid flow at reservoir conditions should lead to a fuller understanding of flow processes and their application to reservoirs. Here are results from the initial step of such a study. Some of the topics are: external gas and water drives, solution-gas drives, and steady-state flow.

On The Job . . . In The Fields 160

A recently developed casing shoe has a formation packer to give protection to formations below the shoe during cementing of tubing or casing. The seats and plugs are pumped out after cementing, leaving nothing to be drilled out.

Pipelining

Gager's Slide Rule Reduces Gathering Losses 142

By R. L. Johnson

This is a simple device to compute crude-oil lease-tank runs. It automatically calculates the volume of crude oil gathered from a given lease tank upon one setting of its single dial. It has found wide acceptance in the field.

Pipeline Patrol: Construction Report 167

DEPARTMENTS

They Say	69	COST-imating	164	Deaths in the Industry	246
Calendar of Events	74	Pipeline Patrol	167	Statistical Summary	247
Journally Speaking	79	Drilling Contractors	180	Drilling Statistics	248
Editorial	81	New Equipment	192	Supply Statistics	249
Watching Washington	87	Trade Literature	205	Refining Statistics	250
International News	102	Equipment Men in News	209	Markets	251
On the Job—Fields	160	Exploration Highlights	215	Classified Advertising	252
On the Job—Plants	163	Personals	244	Advertisers' Index	257

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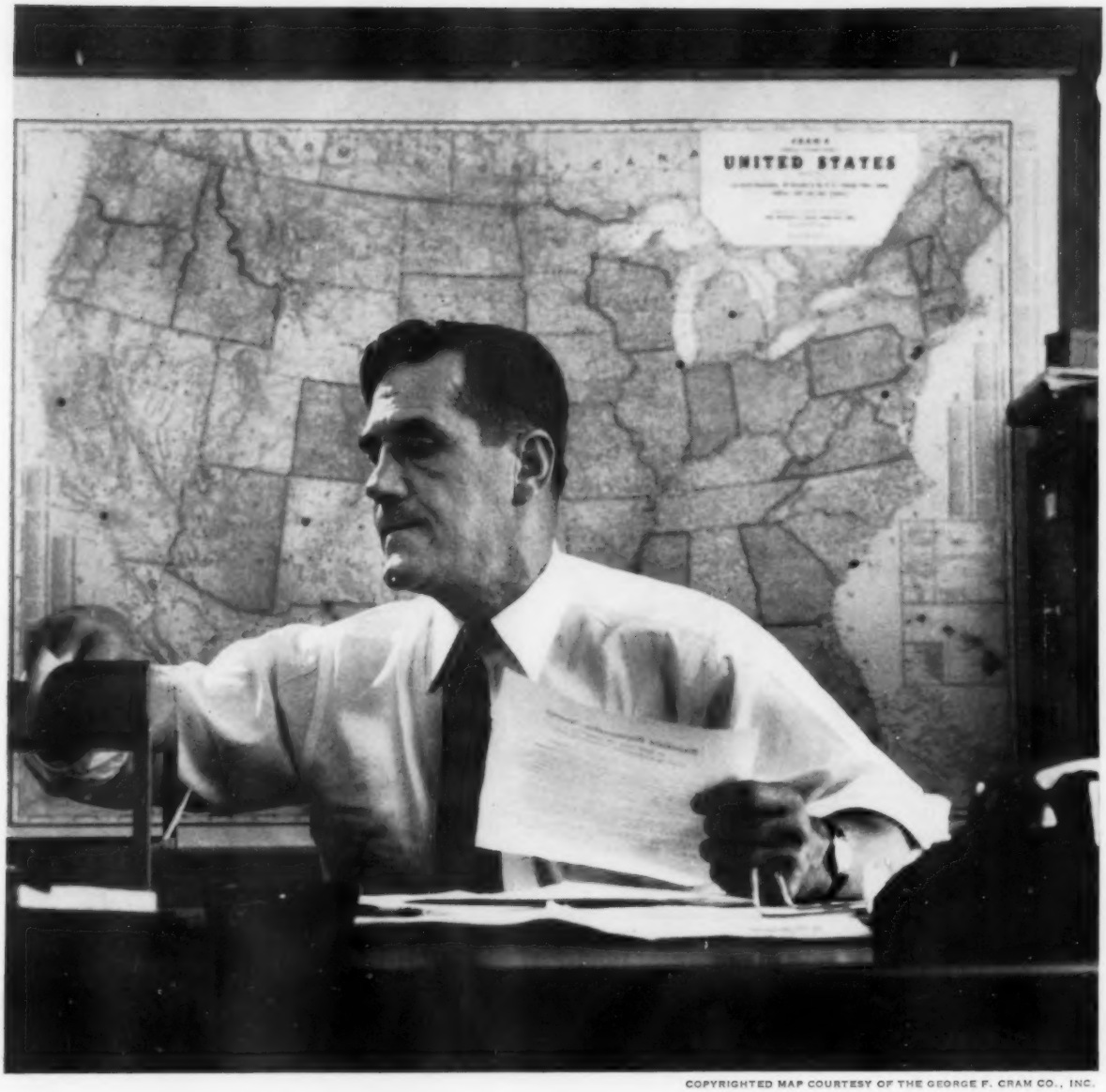

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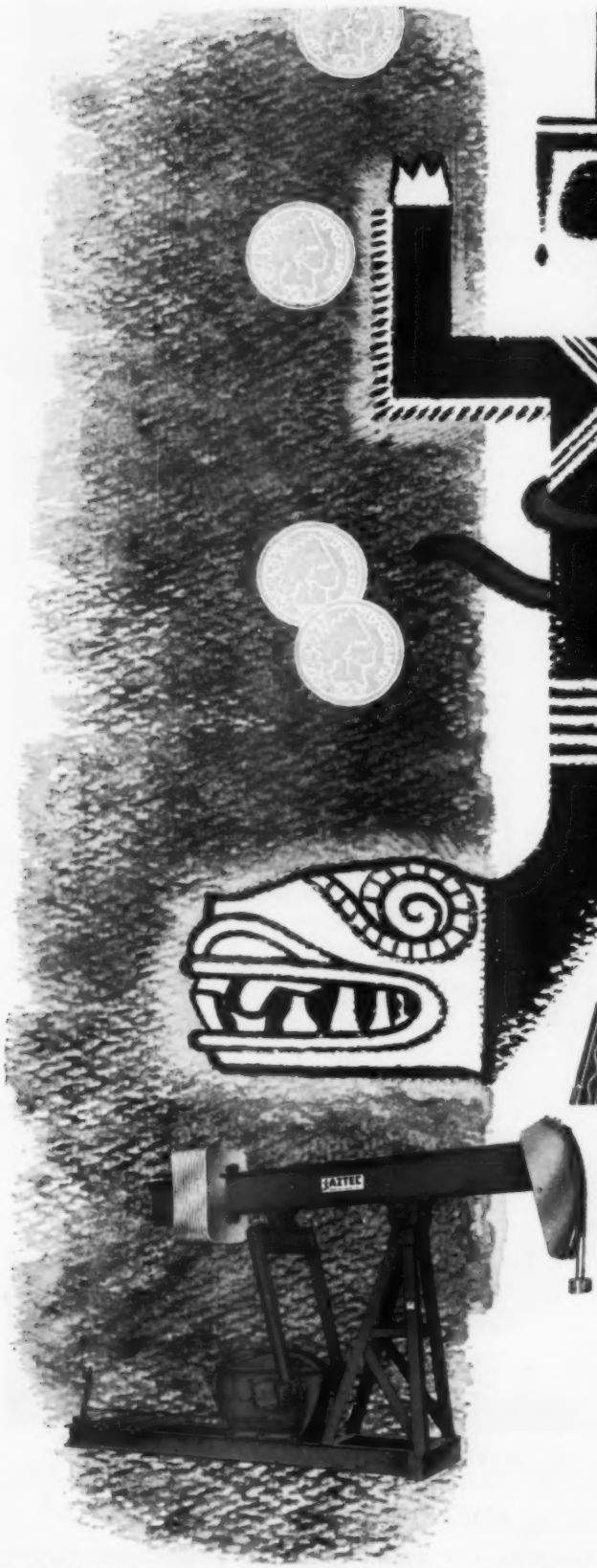

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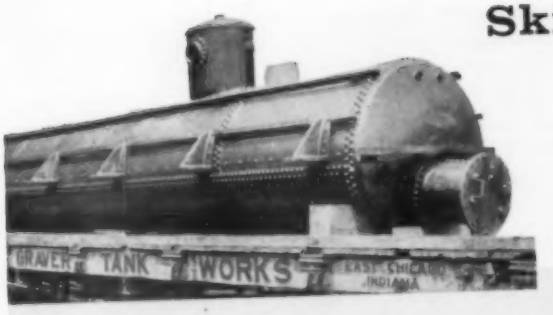


Skilled Then... in Quality Riveting As Today... in Quality Welding

Riveted Semi-elliptical Fire Still—1919

-GRAVER-

— 50,000 —
—100,000—
—150,000—

GALLON TANKS (like cut) IN STOCK
For PROMPT SHIPMENT & ERECTION
WRITE for PRICES & SPECIFICATIONS

In **1857** with a small shop and all hand tools, we demonstrated our ability to make **good** tanks. In **1913** with a large plant most fully equipped with modern power tools, we are able to demonstrate our ability to make **better** tanks. The passing years have taught us many things, but best of all they have demonstrated to the trade in general the soundness of our early theories on tank construction.

STEEL TANKS AND PLATE WORK

Material in stock for small tanks of 500 to 20,000 gallons capacity

WM. GRAVER TANK WORKS
EAST CHICAGO, IND. (148th and Todd Ave.)

DENVER, COLO., 1718 California St. | SALT LAKE CITY, 109 West Second St. | LOS ANGELES, CAL., 312 Security Bldg.

Some of the many types of riveted fabrication by Graver, as advertised in National Petroleum News, July, 1913

Welded Fractionator Tower—1957

Joining plate with rivets for processing equipment, pressure vessels and storage tanks would be quite unsatisfactory today. Yet, before welding became an accepted fabricating technique, to which Graver contributed measurably in perfecting, Graver's boring and riveting methods were recognized as the most advanced in the country. Today, the most advanced welding, X-ray testing, stress-relieving and assembly methods are employed. This is what you can always expect from Graver—a pioneer in skilled steel and alloy fabrication for 100 years!

1857-1957 GRAVER® Our 100th Year

Building for the Future on a Century of Craftsmanship in Steels and Alloys

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
PITTSBURGH • DETROIT • CHICAGO • TULSA • SAND SPRINGS, OKLAHOMA
HOUSTON • NEW ORLEANS • LOS ANGELES • SAN FRANCISCO • FONTANA, CALIFORNIA

GOODYEAR INDUSTRIAL PRODUCTS
G.T.M.-Specified
Style 3153H Rotary Hose for high-pressure drilling
A
B
C
D
A Cover of extra-heavy gauge compound resists gouging, weathering and wear
B Plies of heavy fabric plus high-tensile cable steel wire and wire helices at ends for exceptional strength with flexibility
C Fabric breaker strip
D Heavy mud-, abrasion- and oil-resistant tube

171,800 feet in 25 holes—and still going strong

Tough jobs are routine to the operator of this rig. Recently he had to drill through strata so hard that it took 30 days to go down just 2,100 feet. And that's only a small sample of the *171,800 feet of work turned in by his Style 3153H Rotary Drilling Hose. It already has 25 completed wells to its credit—and still looks good for many more.*

So you can chalk up another cost-slashing recommendation to the G.T.M.—Goodyear Technical Man. He specified Style 3153H Rotary Hose for this extra-severe service because it's precision-built with high-tensile steel cable reinforcement—designed to withstand high, bottom-hole pressures 15,000 to 20,000 feet down. In fact, every length is factory-tested and *guaranteed* to 5,000 psi.

And remember—Style 3153H Rotary Drilling is only one of many types of Goodyear hose. And they're only part of an entire family of industrial rubber products – designed to save time and money in oil-field work. For the full story on any of them, contact your G.T.M. through your Goodyear Distributor—or by writing Goodyear, Industrial Products Division, Akron 16, Ohio.

ROTARY DRILLING HOSE by

GOODYEAR

THE GREATEST NAME IN RUBBER

Flexsteel—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and nonrubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*

PETROCHEMICALS

another broad field for UOP service to oil refiners . . .

In its business of developing improved refining processes for the oil industry, Universal Oil Products Company has long been vitally concerned with effective means of producing the valuable chemical products from petroleum. The great worth of these petrochemicals to our national economy is recognized by everyone. They are vitally important to the refining industry, too, if refiners are to maximize the value of products from crude oil processed through their plants.

In the interest of the oil refining industry UOP has recently established a program of petrochemical process and marketing development. Under this program any refiner, anywhere in the free world, regardless of the volume of his operation will be able to enjoy the economic and operating advantages which the production of the petrochemicals most suited to this operation can provide.

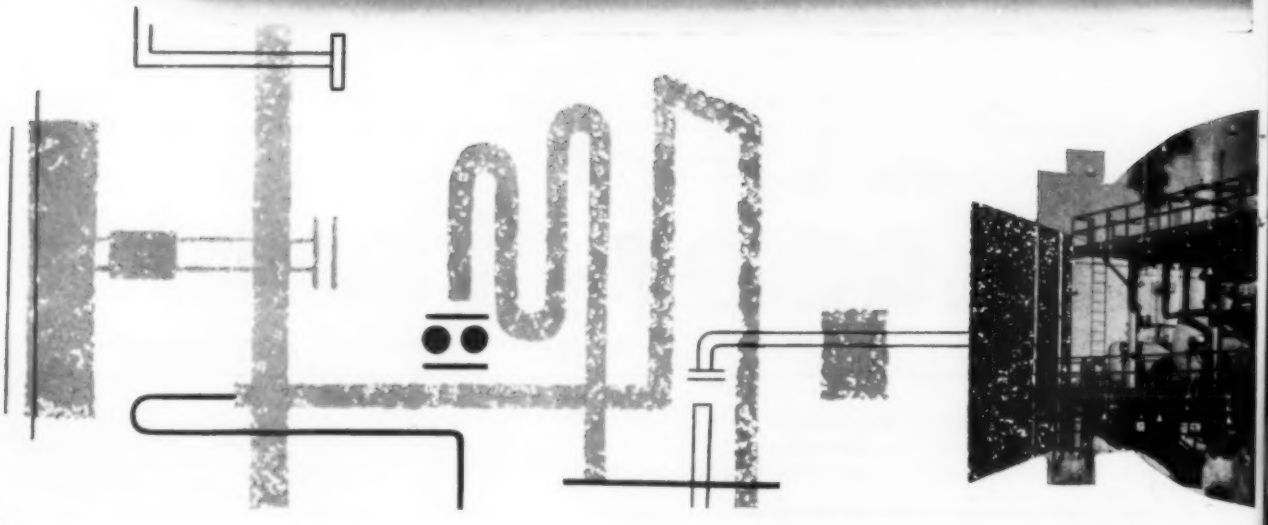
This new petrochemical program makes available to you, through UOP, a variety of petrochemical processes.

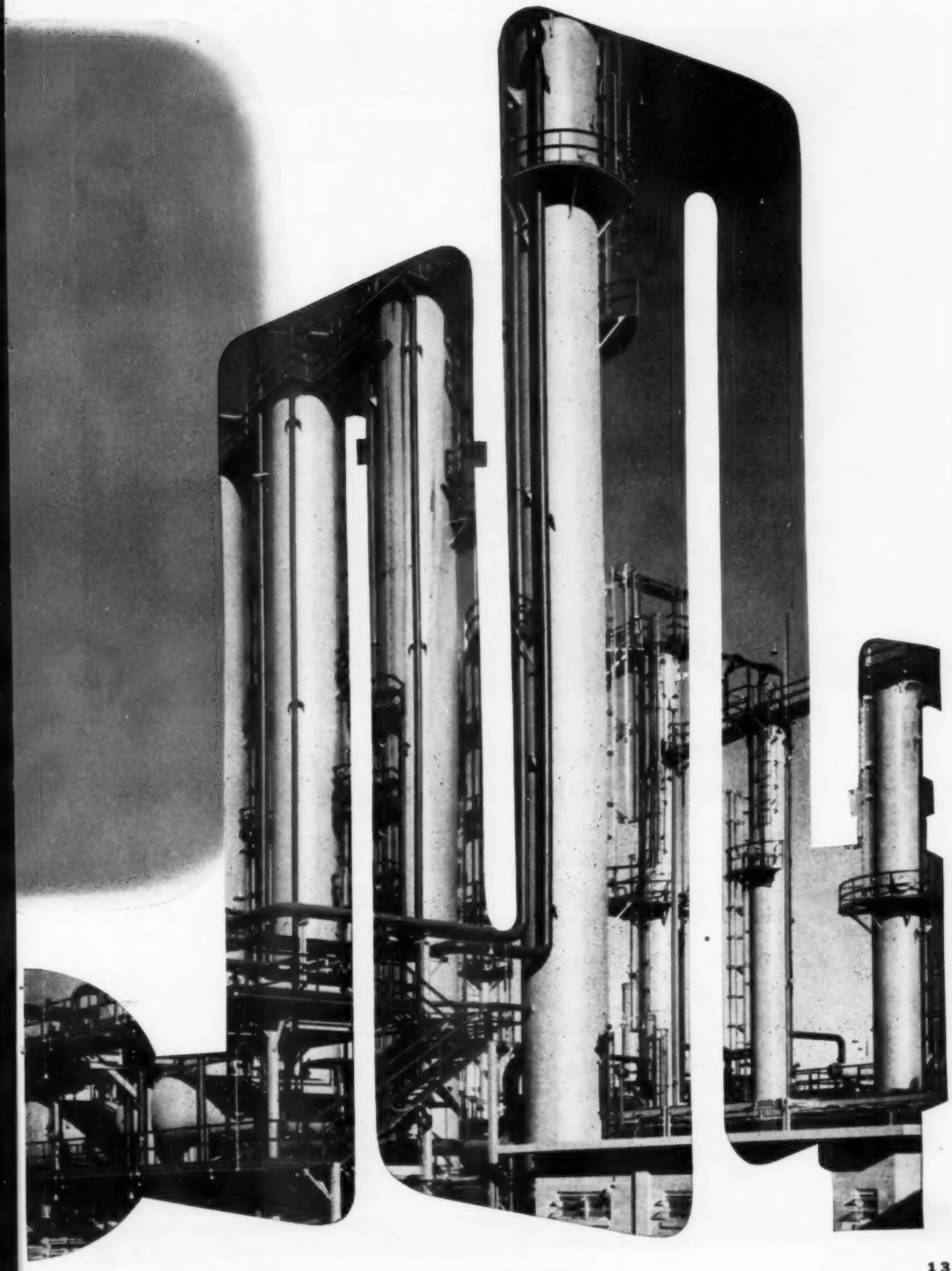
UOP®

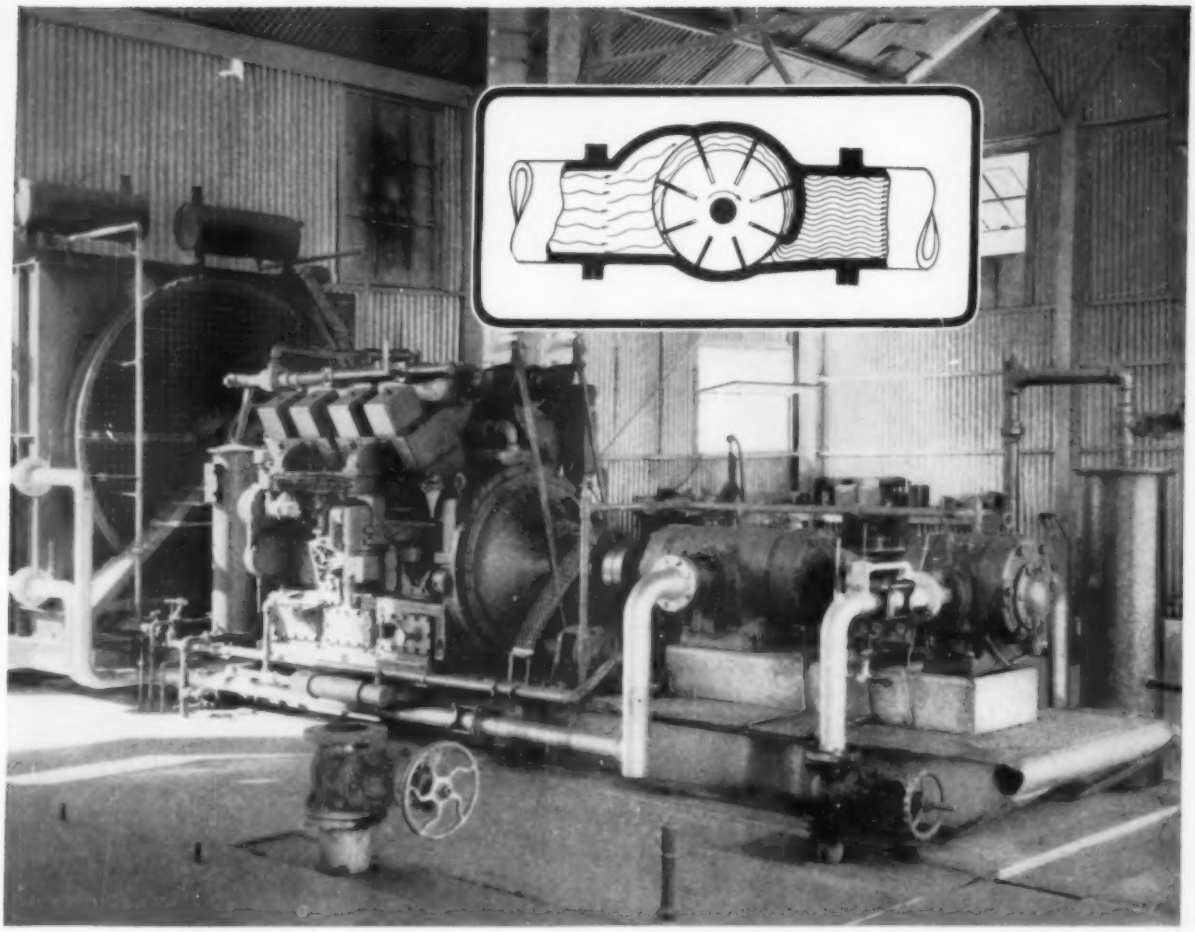
UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U. S. A.

More Than Forty Years Of Leadership In Petroleum Refining Technology







DEEP IN THE HEART OF TEXAS
...FULLER ROTARY COMPRESSORS ARE ON THE JOB

. . . More and more, the petroleum industry is turning to Fuller for dependable, trouble-free service. Indoors or out, Fuller Rotary Compressors can withstand the most rugged use with minimum maintenance and operating costs.

•

There's good reason too—

There are no valves, crankshafts, crossheads or other moving parts to require constant attention, adjustment, or replacement. What's more, the blades of a Fuller Rotary are held out by centrifugal force, automatically compensating for wear and maintaining original capacity for the life of the machine.

Here, near Stinnet, Texas, is a C-100-100H Fuller Rotary Two-stage Compressor, giving day-in-day-out service boosting casing head gas from 5-lb to 115-lb. It is equipped with a radiator section for gas intercooling, a section for engine jacket water cooling, and a section for compressor jacket water cooling.

There is a Fuller Rotary Compressor to fit your particular needs. Complete details, as well as sizes available on request. Write.

FULLER COMPANY
132 Bridge St., Catasauqua, Pa.
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
Birmingham · Chicago · Kansas City · Los Angeles · San Francisco · Seattle

C-317
4692

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

Here's Why . . .

Silicone Insulation Offers New Economy For Outdoor Motors

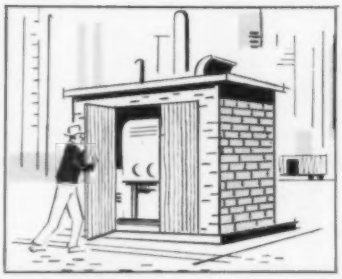
Silicone insulation is establishing a trend towards less costly enclosures for outdoor motors. By readily withstanding moisture and contaminants circulated in ambient air, silicone insulation makes possible more open enclosures and lower motor cost per horsepower.

Several leading electrical equipment manufacturers now offer a line of silicone-insulated "all-weather" motors in most large horsepower ratings.

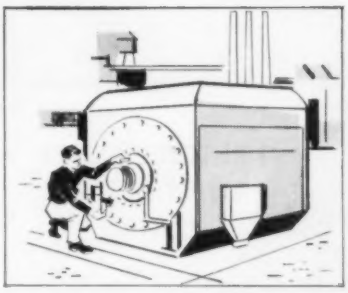
Safe, reliable operation outdoors the year 'round is assured by Dow Corning silicone insulation. Experience has shown silicone-insulated motors readily withstand torrential rains, hurricane winds, corrosive fumes, wind-driven dust, snow, sleet, cold and heat.

Long insulation life is assured by the water-repellent silicone-insulated windings that survive even flooding. Silicone insulation on motors, generators and transformers provides up to 50% greater service factor for absorbing overloads, adds immeasurably to reliable operation and increases insulation life 10 times or more. That's why it's wise to—

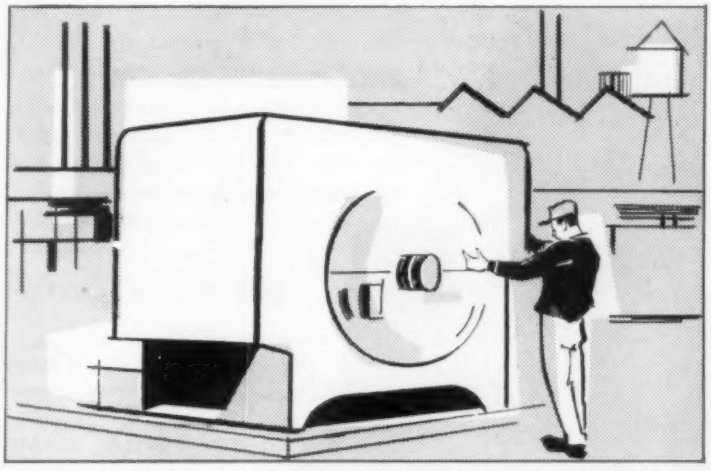
SPECIFY DOW CORNING SILICONES *and Save*



Initially, motors were sheltered in buildings . . .



Later, motor enclosures themselves sealed out surrounding atmosphere



Now, silicones protect motor parts permitting the circulation of ambient air and lower-cost enclosures.

first in silicones

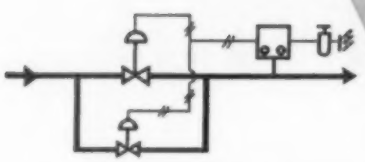
Dow Corning CORPORATION

MIDLAND, MICHIGAN

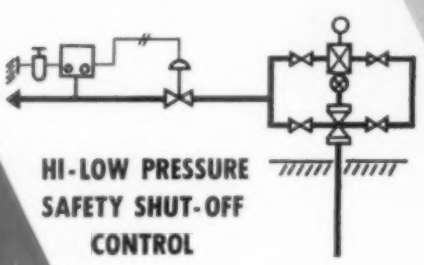
Atlanta • Boston • Chicago • Cleveland • Dallas • Detroit • Los Angeles • New York • Washington, D. C.

For Optimum Pressure Control, Specify BS&B 72-14 Pressure Controllers And Transmitters!

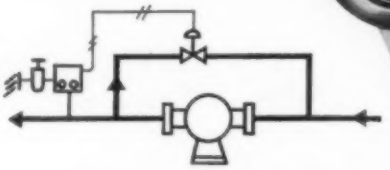
Proportional ⋆ On-Off ⋆ Differential Gap
Indicating Or Non-Indicating



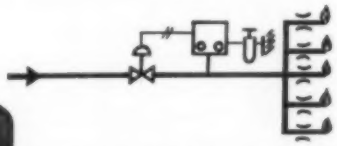
PRESSURE REDUCING CONTROL



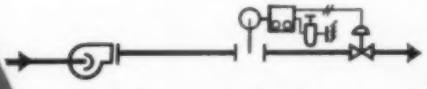
HI-LOW PRESSURE SAFETY SHUT-OFF CONTROL



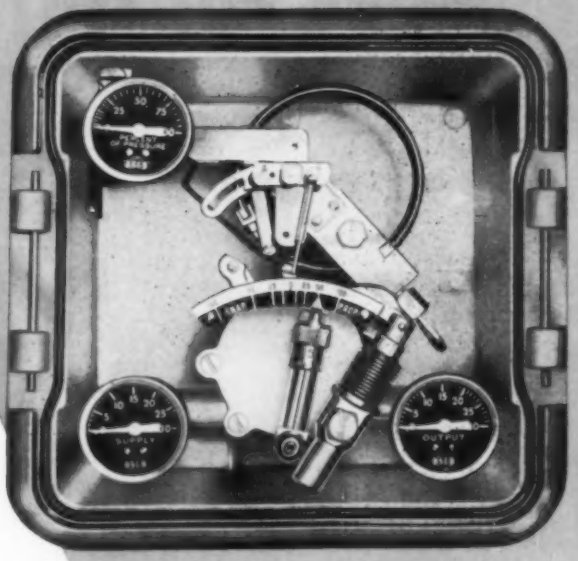
BACK PRESSURE CONTROL



LOW PRESSURE CONTROL



DIFFERENTIAL PRESSURE ...FLOW CONTROL



FEATURES OF POWER UNIT:

- Three-To-One High Capacity Relay
- Vibration Proof
- Push Button Cleanout
- Factory Calibrated Feed-Back Bellows
- Micrometer Adjustment

Ask Your BS&B Sales Engineer For Full Details, Or Write For Catalog 72-14.

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TO SERVE YOU BETTER

"We have to know our business to serve your business." That's an unwritten slogan at Texas Employers' Insurance Association. Service in any industry is rendered through people and *superior* service is provided by those most highly trained in their respective professions.

Texas Employers' leading position in its industry is due largely to its plan of sponsoring and encouraging specialized education and training programs for all levels of its management and employees... equipping them with the knowledge and skills necessary to serve employers of labor in Texas more efficiently.

Complete specialized training courses are conducted by the Claims, Engineering and Sales departments, with other departments carrying on informal training sessions for their employees. Other company-sponsored programs include courses offered by the Insurance Institute of America, the American Mutual Insurance Alliance, the American Institute for Property and Liability Underwriters, the American Management Association and other recognized national groups.

People who know their business and who can serve your business efficiently — this is one more of the advantages offered by the Texas Employers' Insurance Association... advantages which have provided SERVICE, SECURITY and SAVINGS to Texas business and industry for over 43 years.

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WORKMEN'S COMPENSATION
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Now one unit does two jobs

The New Cenco® AUTOMATIC TITRATOR measures both mercaptans and olefins

Just by a change of electrodes and the flick of a switch, this one versatile instrument can measure both mercaptans and olefins . . . rapidly . . . accurately . . . and automatically. It's amazingly simple to operate—capable of titrating a wide range of concentrations without the use of standard solutions. And from 15 to 20 consecutive analyses can be run without an instrument adjustment. Reaction time registers in tenths of seconds directly on the Titrator.

Here's a dependable instrument, designed to economically increase efficiency in your laboratory operation. The unit is enclosed in a sturdy, compact metal case . . . finished in blue gray hammertone. The overall dimensions are 12" x 12" x 4½".

The Cenco Automatic Titrator has been licensed under patent rights of the Standard Oil Company (Indiana).

No. 20928-1 Cenco Automatic Titrator, with electrodes for mercaptans—$595.00

No. 20928-2 Cenco Automatic Titrator with electrodes for olefins—$625.00

The combination instrument with both sets of electrodes, **$675.00**

For more information, write for circular No. 1264A.

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Easiest, fastest way to kill fire...
KIDDE'S NEW DRY CHEMICAL EXTINGUISHER

Here – from Kidde – is the newest, the fastest, the easiest-to-operate dry chemical fire extinguisher!

Look at the extra large, aluminum handle and trigger—even a gloved hand fits comfortably with room to spare. Pick the unit up – it hangs straight – no awkward angle to throw you off balance.

If fire strikes, follow the simple directions: "Remove Horn" – automatically the trigger safety lock is released – "Pull Trigger" – instantly a cloud of fire-killing dry chemical whooshes out of the nozzle and fire's out! With this unit, designed by Kidde engineers working with Henry Dreyfuss personnel, you don't have to be a trained fireman to get perfect results.

Built for a lifetime of use, the handsome new 20 and 30 pound Kidde dry chemical extinguishers have top ratings from Underwriters' Laboratories, require only 225-250 psi charging pressure. The rugged pressure gauge is recessed in handle for maximum protection. Tells at a glance if the unit is ready for use.

Available nationally through Kidde's sales and service organization. Write Kidde today for the name of nearest distributor.

Kidde

Walter Kidde & Company, Inc.
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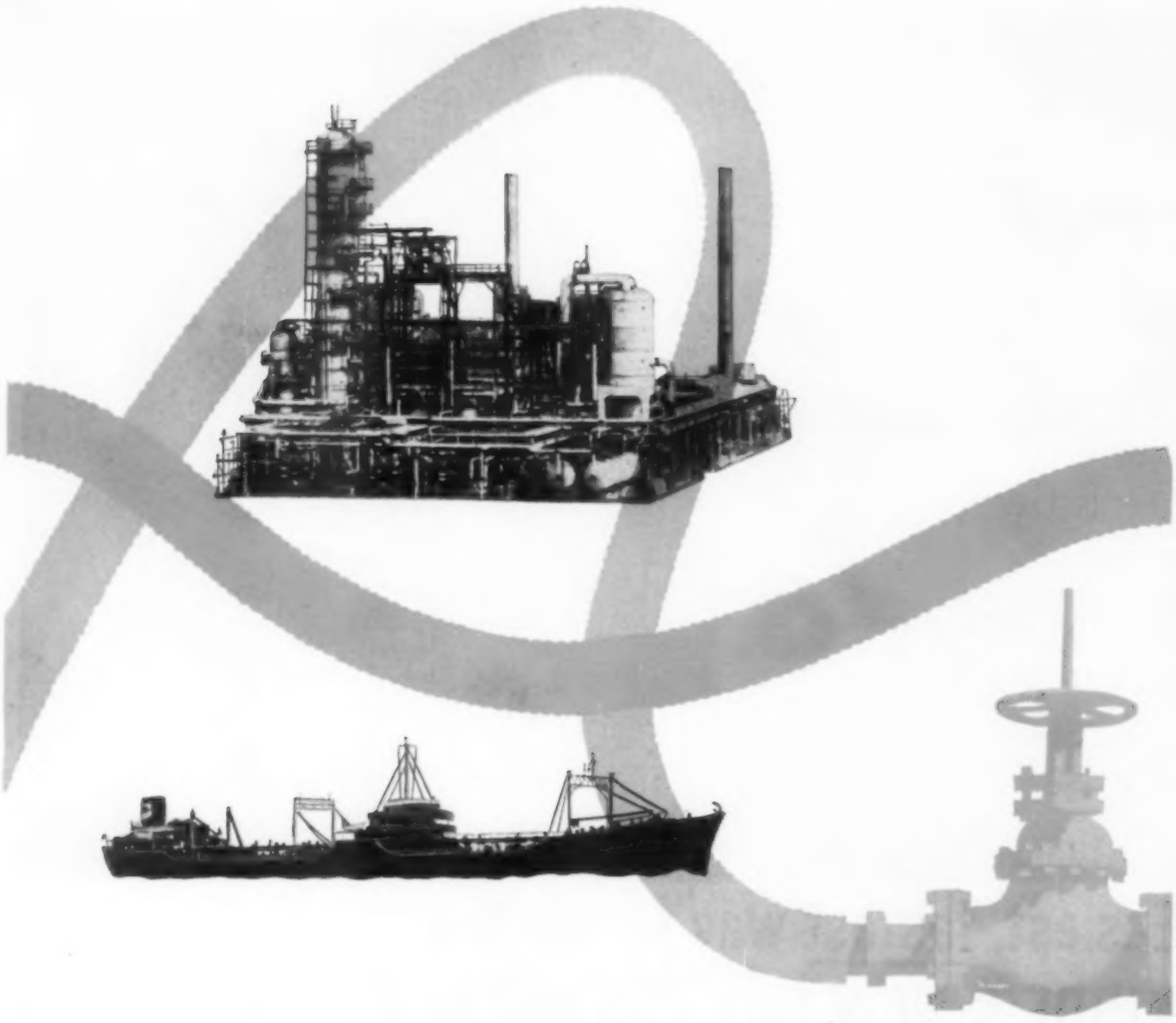


Sun Ship has furnished equipment for many major oil companies in America

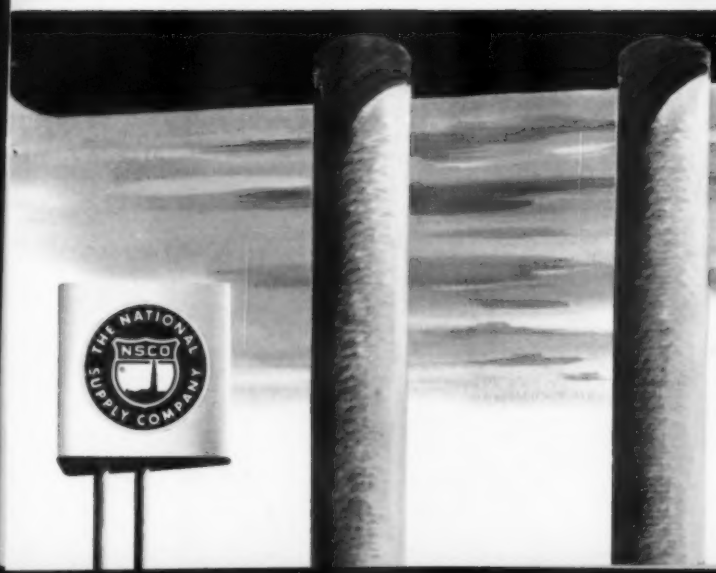
Of essential importance to American welfare is the free, expanding progress of the Oil Industry. Tankers for many of the oil companies have been built in the Sun Ship Yard. Also, refining equipment repairs and replacements have been furnished for the major oil companies.

In addition, Sun builds special machinery and fabricated steel products for a variety of other industries whose problems have been a welcome challenge—readily accepted—easily solved. Call or write our Sales Engineering Department about your plans—or problems. Immediate, courteous attention is assured.

Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE (SINCE 1916) CHESTER, PA.



You'll solve more operating supply problems here!

It's always good business to anticipate the need for supplies before it occurs. You'll save time and money when you do this at a National Store.

(*Continued on next page*)

(Continued from preceding page)

Come into a National Supply Store and we'll prove it to you. First, you'll see an extensive inventory of brand name tools, parts, accessories and supplies—displayed in bins, counters and warehouse areas for your personal examination and selection. Actually, you have all the buying conveniences of a modern supermarket, including up-to-date price information. You can plan and buy most efficiently when you shop in the store!

You can also get more useful product information at a National Store. Maintenance instructions, charts of equipment ratings and other helpful bulletins are available. You'll find technical descriptive bulletins on drilling and production equipment and accessories.

Finally, you can see for yourself *new* products and improvements in old ones when you stop at a National Store. This is a big advantage you gain by personally visiting the store. You get a first hand picture of what new equipment or methods may mean in improving your operations.

Complete stocks, complete product information and everything that's new . . . the crew in the National Supply Store nearest you is always ready to provide these advantages for your operation.

Below, a Spang inspector uses a master gauge to check thread accuracy on Extreme Line Casing at National's Ambridge, Pa., plant —one of the nation's largest plants for the exclusive production of oil field tubular goods.

Precision manufactured SPANG® Extreme Line Casing is the finest you can buy

When the chips are down and there's likely to be trouble, most operators insist on SPANG Extreme Line Casing. When well conditions dictate that only the finest casing can be used, SPANG Extreme Line again gets the nod. Naturally, a long history of exceptional performance in every type of well has built such a reputation for this SPANG product.

Two major ingredients are responsible: The SPANG Extreme Line Casing Joint *and* the extremely accurate manufacturing processes used to produce this casing. The design of the joint means that it is easy to run and re-run repeatedly—it is 100% leak-resistant and has high joint strength—it is streamlined for maximum running efficiency and clearance—it has a minimum number of threaded connections.

The special steps taken to produce this casing mean it will give you the high quality performance required. From ingot steel to barge or gondola car, the making of Extreme Line casing is checked many times, many ways. Countless lab tests and many inspections (including the new Magnaglo process in grade P-110) are used to assure its high quality.

Remember these important ingredients when you consider the requirements for your next well. Talk it over with the people who have *specialized* in high quality oil field tubular goods for over 40 years—National Supply's SPANG Division and its representatives in your area.

SPANG-CHALFANT DIVISION

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION TUBULAR OFFICES: Dallas, Texas; Denver, Colorado; Houston, Texas; Los Angeles, California; New York, N. Y.; Toledo, Ohio; Tulsa, Oklahoma; Calgary, Alberta, Canada
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

THE NATIONAL SUPPLY COMPANY NSCO

Need top-quality Spang CW pipe for general service work?

See the next page

Top quality... SPANG® CW Steel Pipe for oil field service

When it comes to laying dependable gathering or feeder lines in a hurry, high quality SPANG CW can really help your schedules. Because it is made under the same quality control conditions as SPANG oil field tubular products, you'll find it easy to work with . . . easy to cut, bend, thread and weld. It will save time on the job, give you faster installations . . . and years of rugged service.

Why not check at the nearby National Supply Store now. There, you'll find available all sizes of SPANG CW—plain end or threaded and coupled—to meet your service pipe needs . . . for gas lines, water lines, oil lines.

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MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
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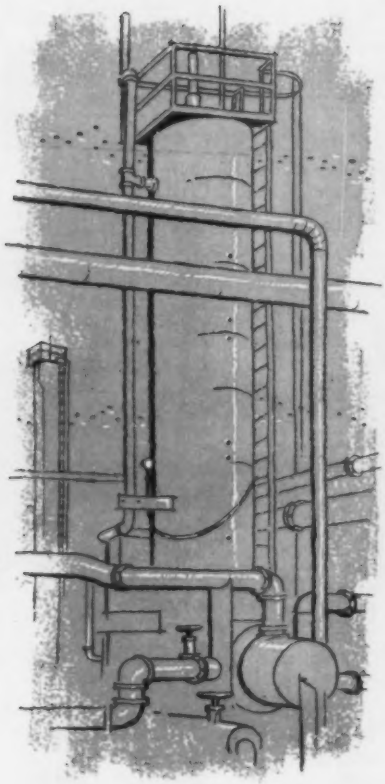
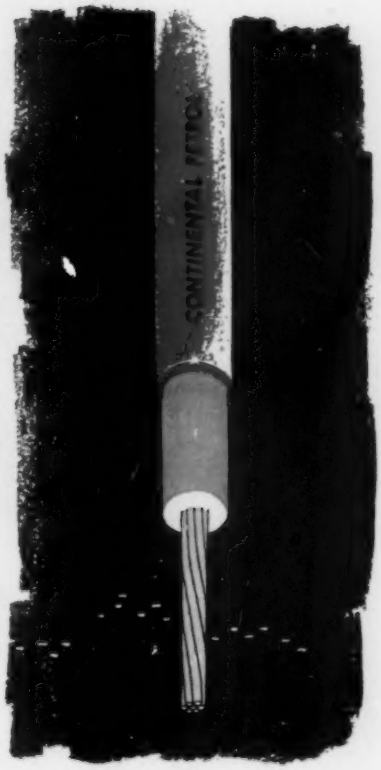
now! *a low cost gasoline/oil resistant insulated wire . . . the NEW Nylon-jacketed*

CONTINENTAL *PETROL* WIRE





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Continental

WIRE CORPORATION

WALLINGFORD, CONNECTICUT

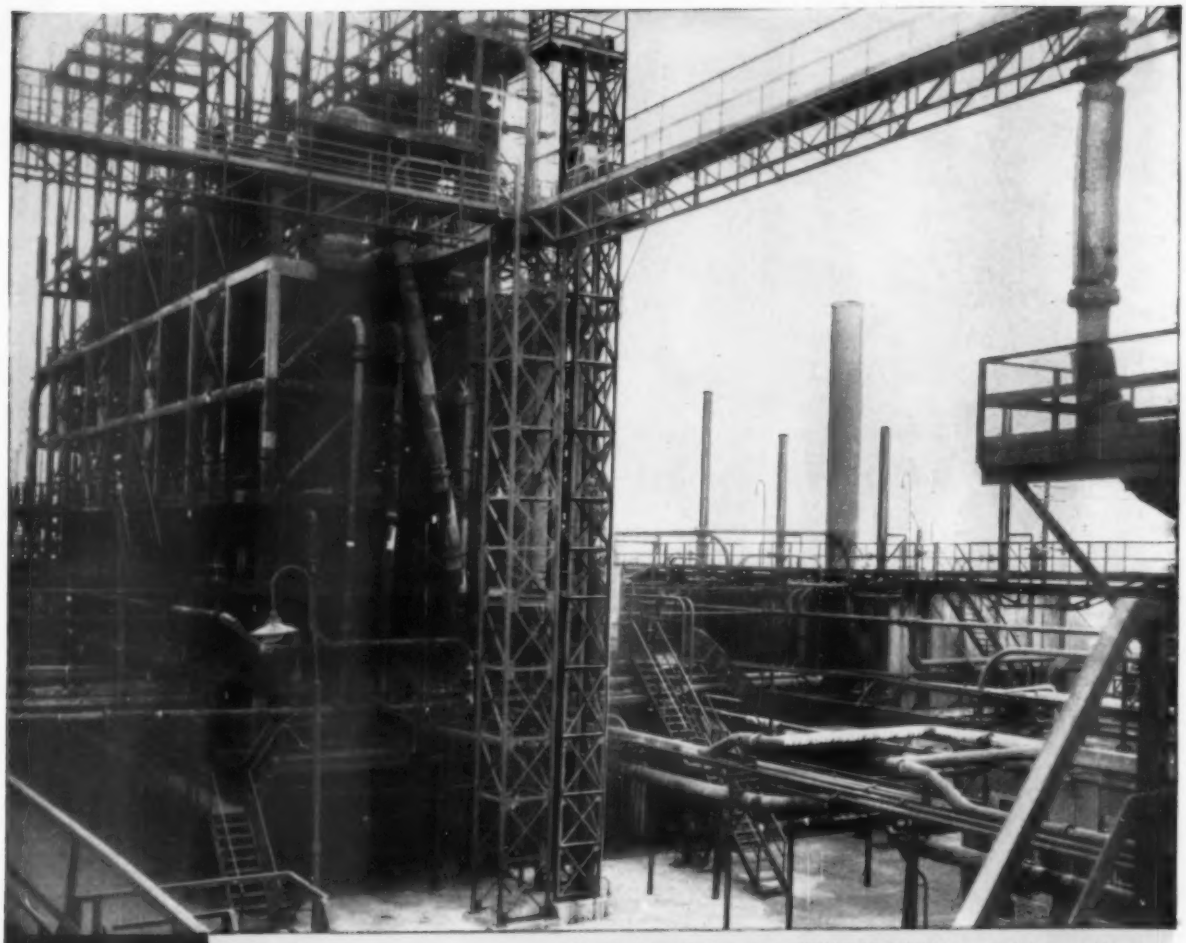
YORK, PENNSYLVANIA

Looking for a low-cost gasoline and oil resistant insulated wire? An insulated wire approved for use in wiring gasoline pumps and in refineries BUT at lower cost than lead jacketed rubber insulation? Then you've been looking for this NEW Continental PETROL wire.

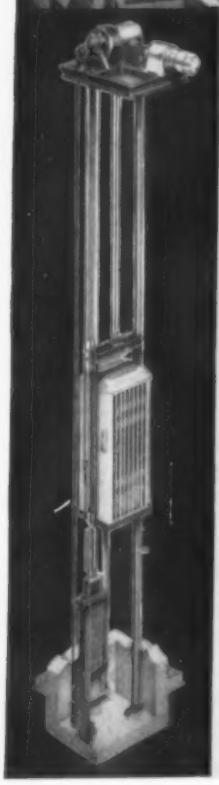
Nylon-jacket over thermoplastic insulation, PETROL wire is not affected by most oils, acids and alkalis. It is approved by Underwriters' Laboratories for 30°C in gasoline . . . 60°C in oil or air.

Available in sizes from 14 to 6 AWG . . . in a rainbow-range of colors. For more information on the new Continental PETROL wire, outline your requirements in a letter and mail to us immediately. A Continental field engineer will be glad to help with any insulated wire problem in your area

FREE 72-page catalog of the complete line of Continental Insulated Wire and Cable available on request. Send for your copy today.



A typical installation of an EHRSAM ELEVATOR at a Gulf Coast refinery.



Safe, Low Cost EHRSAM
ELECTRIC ELEVATOR FOR "CAT" CREWS

FACTS:
Complies with American Standard Safety Code, all state and local codes. Machinery and cab can be furnished galvanized for outdoor installation . . . lift rate, 90 ft. per minute. For special applications, speeds of from 50-120 ft. per minute are available.

SIZES:

2'3" x 2'3"	—	300 lb. capacity (1½ Hp.)
2'9" x 2'9"	—	500 lb. capacity (2 Hp.)
4' x 4'	—	1000 lb. capacity (3 Hp.)
4'6" x 6'	—	2000 lb. capacity (7½ Hp.)

Maximum lift 250 feet. All-metal car with collapsible door. Magnetic brake. Emergency exit and safety door. Rigid, electric-welded all-steel frame.

All components factory assembled and pretested for easy installation. Complete operating instructions and detailed drawings included with each unit. Furnished with all elevator safety equipment required by code. All electrical equipment can be furnished explosion proof for either 220 or 440 volts.

WRITE, WIRE OR PHONE FOR ILLUSTRATED BROCHURE AND LIST OF EHRSAM ELECTRIC ELEVATOR CUSTOMERS.

Push-button, car-type for 1 to 6 passengers. Easy to run, inexpensive to operate, simple to install.

EHRSAM®

THE J. B. EHRSAM & SONS MFG. CO.
DEPT. OG, ENTERPRISE, KANSAS
"OVER 80 YEARS OF DEPENDABLE SERVICE"

SALES OFFICES: Denver, Colorado; Fort Worth, Texas; Kansas City, Kansas.
WEST COAST: Ehrsam Pacific, Inc., Riverside, California.

One of a series.

Some Things to Think About Steam Traps

. . . in order to get high operating efficiency and a minimum of maintenance

The gentleman who invented the wheel had a basic idea and so far no one has come up with anything better for the purpose.

If you'll pardon us for a little overemphasis on the significance of steam traps, we'd like to liken one of them to the wheel.

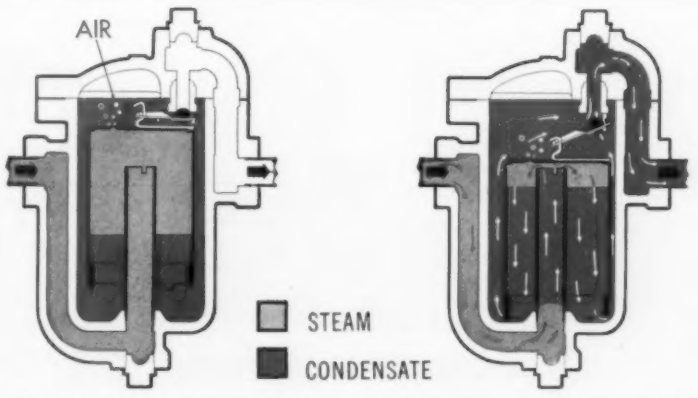
In 1911, when the first Armstrong inverted bucket steam trap model was announced to the world, or at least that part of the world that modest advertising and sales budgets would cover, it was not received with equal enthusiasm by all (especially old-style trap makers). But, like the wheel, it managed to find its way into general use. And, nothing better has ever turned up for the purpose of draining condensate. As a matter of fact, the Armstrong trap has been very widely copied. Today, there are more inverted bucket traps draining process equipment than any other kind. Of these, there are more Armstrongs.

If this sounds like the boasting of a proud parent, give consideration to some fundamental requirements not met by all traps:

1. ***A steam trap should not leak steam.*** Some traps do, you know, because of the nature of their operating principle. No steam ever gets to the Armstrong trap orifice. The valve is always water sealed.

2. ***A steam trap should vent "air" as fast as it accumulates***—otherwise temperatures are reduced and corrosion is a problem. The Armstrong trap handles air very nicely. The vent in the bucket permits air to accumulate in the top of the trap, from where it is discharged when the trap opens. For extreme conditions like draining paper machine dryers, some jacketed kettles and certain other units, the vent is sized larger for the job. And, for handling big volumes of air during warm-up, a bucket with an auxiliary thermic vent really speeds up heating.

3. ***A steam trap should discharge condensate at steam temperature*** if you want to get maximum efficiency from the unit drained. And most people certainly do. If you have to wait for the condensate to cool, it's almost impossible to maintain maximum temperatures and prevent air build-up. You guessed it—the Armstrong trap opens for water, without dependence on temperature.



Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

4. ***A steam trap should be suitable for any return system.*** The Armstrong trap works just the same whether discharging to atmosphere, back pressure or vacuum. It has been conclusively proved that flash steam resulting from use of a bucket trap does not cause a problem in vacuum return systems. The flash condenses rapidly. It's the leaky traps that cause the headaches.

5. ***A steam trap should not be a "prima donna".*** Some kinds of traps take an awful lot of care and coddling. The Armstrong trap is a rough and ready type with a hardened chrome steel constitution (valve and seat, to be exact). It cleans itself of ordinary dirt and scale without choking up. Its 18-8 stainless parts stave off rust and corrosion. It resists wire-drawing and wear remarkably well. In fact, it stays on the job longer with less attention than any trap ever produced. Unless you live in Siberia, you can probably find a user around the corner who will tell you so from experience.

6. ***A trap should not be an "orphan".*** With Armstrong traps you can *always* get prompt service and parts from nearby Factory Representatives and stocking distributors as well as from the factory.

7. ***A trap should have a guarantee.*** The Armstrong trap is unconditionally guaranteed to give you *complete satisfaction* (as to doing its job, that is). If it doesn't, you can get your money back.

If you'd like to buy some of these excellent steam traps, call your local Armstrong Representative or write. **Armstrong Machine Works, 8684 Maple St., Three Rivers, Michigan.**

ASK FOR the 44-page Steam Trap Book, free on request without obligation.

ARMSTRONG STEAM TRAPS

HALLIBURTON

dump bailer service

SPECIAL SERVICE FOR OIL WELLS

For any of these remedial services, Halliburton Dump Bailer Service can help save you time and money, trouble and worry:

- Nitro-Glycerin Shot Tamps
- Plug Back Jobs
- Water Shut Off
- Caving Conditions in Cable Tool Holes
- Plug Below Damaged Pipe
- Seal for Permanent Bridge Plugs
- Plug to Set Liners
- Special Bailer for Dumping Sand and Gravel
- Dumping Caustic for Removing Magnesium Windows and Bridge Plugs
- Special Head and Stuffing Box for Dump Bailer Braden Head Squeeze Jobs

When your wells need fast treatment, call Halliburton Dump Bailer Service! Ready 24 hours a day, every day of the year.

HALLIBURTON
OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

THESE TOOLS AND MATERIALS CONTRIBUTE TO THE EFFECTIVENESS OF

Halliburton Dump Bailer Service

"DB" BRIDGING BASKET

. . . is an efficient umbrella type that will bridge holes from 4½" to 15" I.D. in casing or open hole. The drillable basket has been used successfully on hundreds of dump bailer jobs and has shown its efficiency in wells exceeding 13,000 feet in depth.

RESIN-CEMENT

. . . is a slurry composed of portland, Hi-Early or Slo-Set Cement, water and thermo-setting resins, suitable for application in wells with temperatures ranging from 80° to 230° F. It is designed for open bottom hole plugs, setting around casing shoe or opposite water zones, and other remedial work on oil or gas wells, particularly where ordinary cementing materials fail. The set Resin-Cement is permanent in nature, is not attacked by oil, gas or salt water, and will resist the action of common acids. With these qualities, any proven plug or shut-off should be permanent and impermeable.

LIMIT PLUG

. . . is used to form a bridge in casing to stop or limit the downward travel of a dump bailer, gun perforator or well fluid to the point in the casing where it is set. Many successful services are economically accomplished through the use of this tool. All parts are drillable, but of sufficient strength to hold squeeze pressures up to 2,000 psi applied from above. The limit plug is not designed to stop or limit upward movement of fluids.

CAL-SEAL

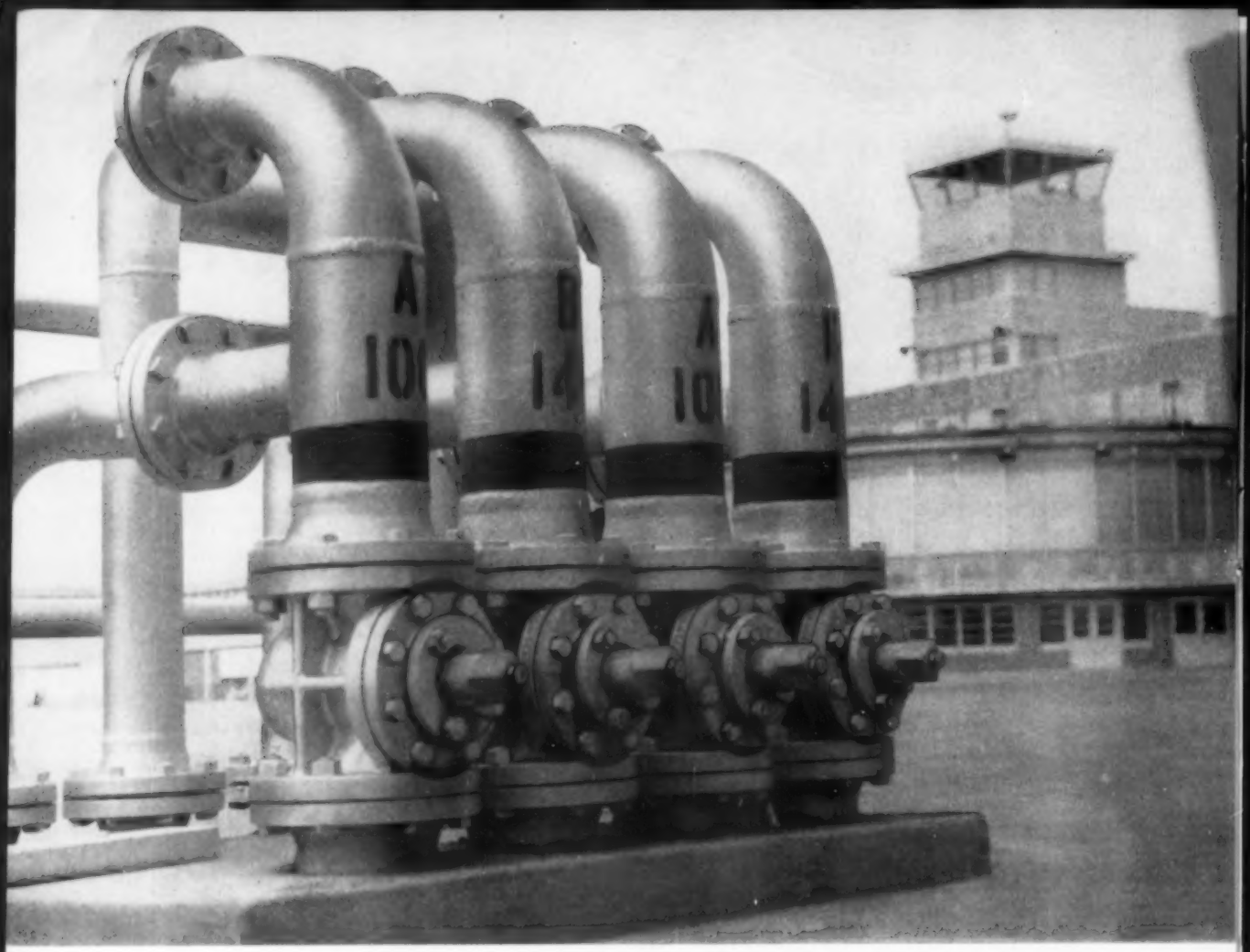
. . . is a super-strength gypsum cement with stabilized, controlled setting times, eliminating the delays necessary with other materials. Upon setting—after remaining fluid during 80% of its setting time—Cal-Seal hardens quickly and one hour after setting attains a compressive strength of 2,500 psi. Cal-Seal has a linear expansion of 0.3% at time of set which gives an unusually tight plug. May be used at temperatures up to 140° F., with special Cal-Seal HT suitable for well temperatures to 170° F. Cal-Seal is readily drillable and the permeability of the set materials effectively controls unwanted gas or oil.

HYDROMITE

. . . is a waterproof plastic cement, composed of a special gypsum cement and a powdered resin, especially adapted for dump bailer service. The setting time can be controlled to very close limits and the initial set takes place in from 75 to 100 minutes. It will set in temperatures ranging from 60° to 180°F. Within ten to fifteen minutes after the initial set, Hydromite has a compressive strength of approximately 1,500 psi which permits further dumping of material in the well. Full strength (approximately 4,000 psi) is obtained in from three to twenty hours, depending upon the well temperature.

DUMP BAILER SERVICE

251 SERVICE CENTERS—JUST MINUTES AWAY FROM YOUR WELL



VITAL MEMBERS OF THE GROUND CREW

The Rockwell-Nordstrom valves shown above have a vital job at one of the nation's largest and most modern airports. They control aviation fuel and lubricants that flow directly from an adjacent tank farm to fueling pits right on the field.

Here's why Rockwell-Nordstrom valves were specified throughout this unique fueling system. *Only* Rockwell-Nordstrom valves assure the positive shut-off so vital to safety and prevention of products contamination. And, because they close with a smooth, easy quarter-turn, flow control is fast and foolproof. Additional benefits: compact design allows tighter manifolding and lubrication eliminates metal-to-metal wear for longest valve life at lowest cost.

Rockwell-Nordstrom lubricated plug valves are available in a full range of sizes and types for every petroleum marketing need. And, they cost no more to buy—often less—than ordinary valves. Write for complete details or see your nearest supplier. Rockwell Manufacturing Co., Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL- Nordstrom **VALVES**

Lubricant Sealed For Positive Shut-Off

OVER 33⅓%

UNDISPUTED LEADERSHIP IN DESULFURIZING OF PETROLEUM—

Contracts for design and construction of over 33⅓% of the nation's total catalytic petroleum desulfurizing capacity have been awarded to Parsons.

Two plants, now under construction, are the largest in the world. They are a 40,000 B/D naphtha desulfurizer and a 50,000 B/D gas-oil desulfurizer.

This is only part of the background that has established Parsons' reputation in design and construction of hydrogen treating facilities.

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means leadership

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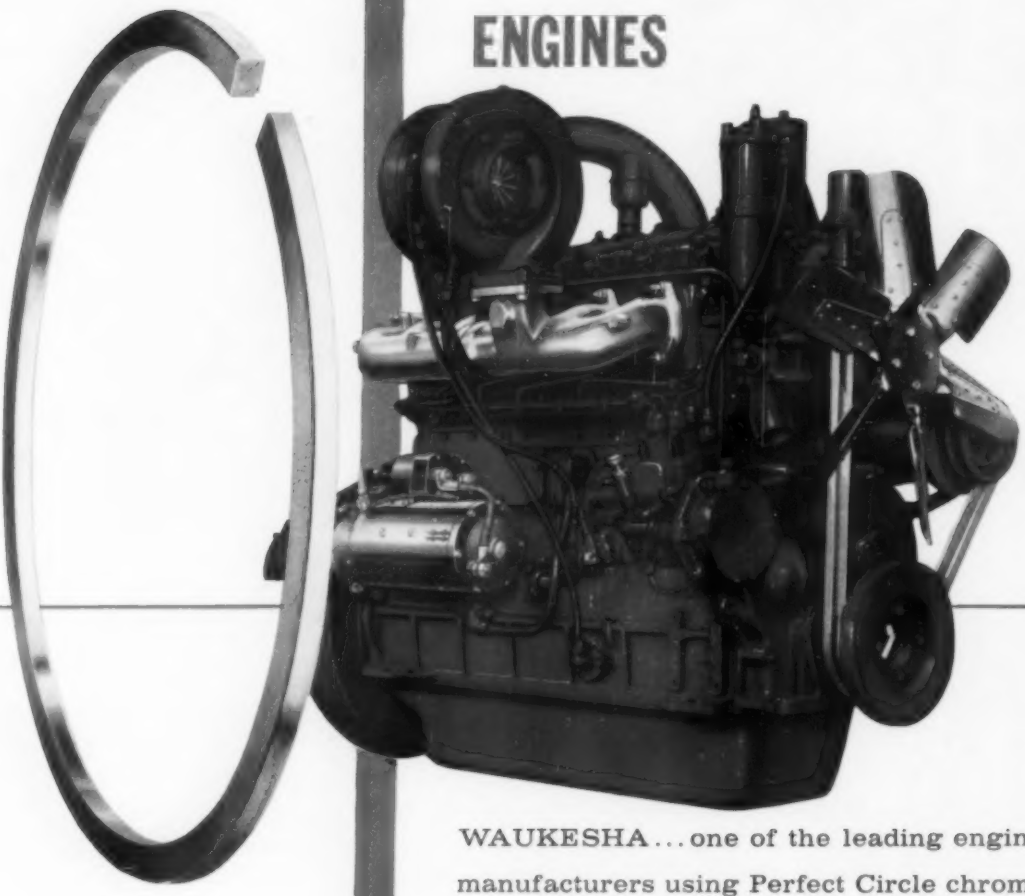
LOS ANGELES

For

Best Performance in

WAUKESHA

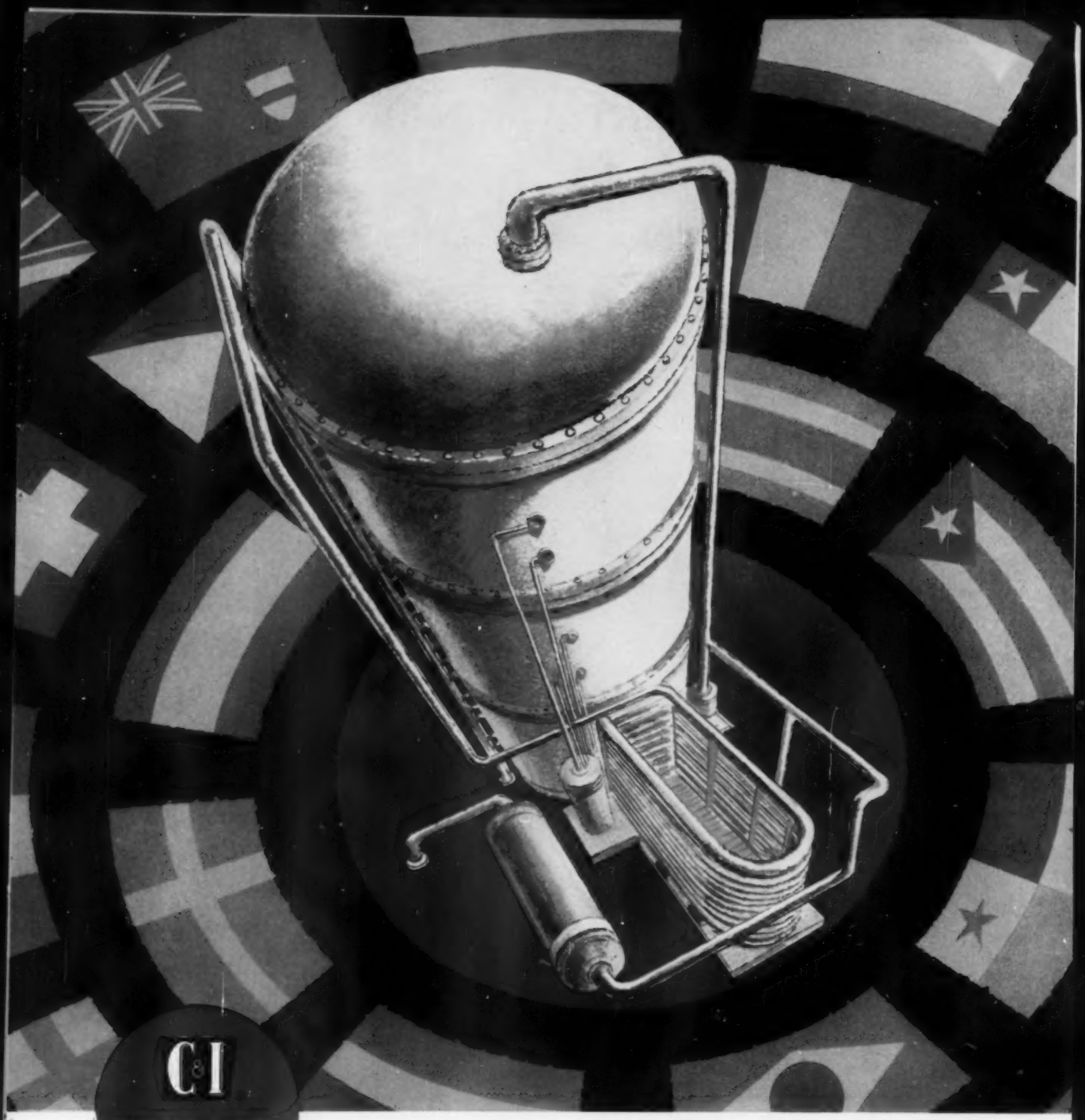
ENGINES



WAUKESHA... one of the leading engine manufacturers using Perfect Circle chrome rings for both original equipment and service requirements

PERFECT CIRCLE

CHROME PISTON RINGS



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NITRIC ACID PLANTS

available world-wide

Through The Chemical & Industrial Corporation, complete facilities for nitric acid are available in all markets of the world. C&I plants employ the du Pont, high pressure process and are designed and constructed to their rigid specifications. Only the finest materials and components are utilized guaranteeing a maximum safety factor, a minimum of maintenance and tremendous day-in and day-out efficiency. C&I nitric acid plants are time tested and proven and the larger units can now be made self-sufficient after start-up.

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Representatives in principal cities throughout the world.

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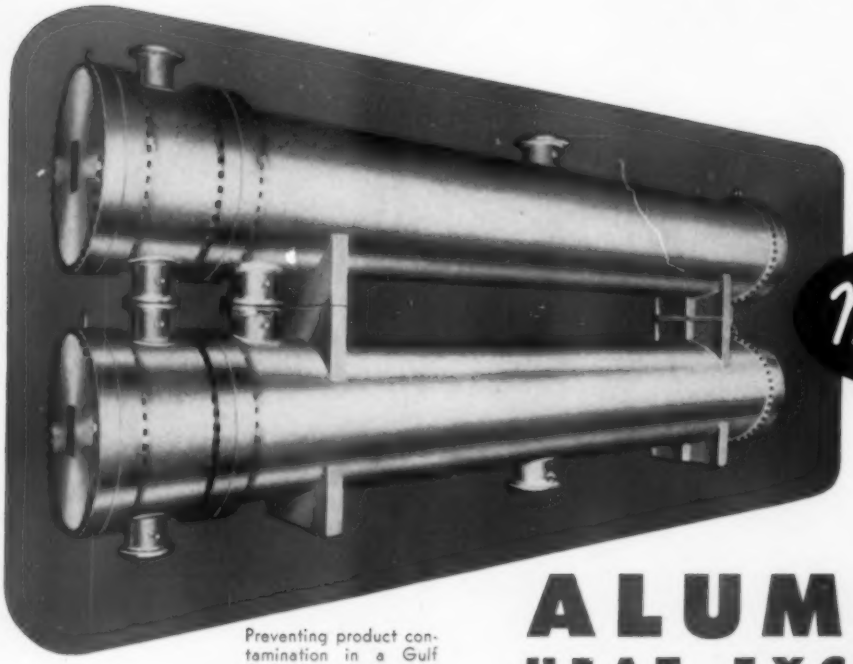
Designers and Constructors of Plants for the Processing of Ammonia Available World-wide.

Visit Us at the 26th Chemical Show. Coliseum, New York, December 2nd to 6th, 1957

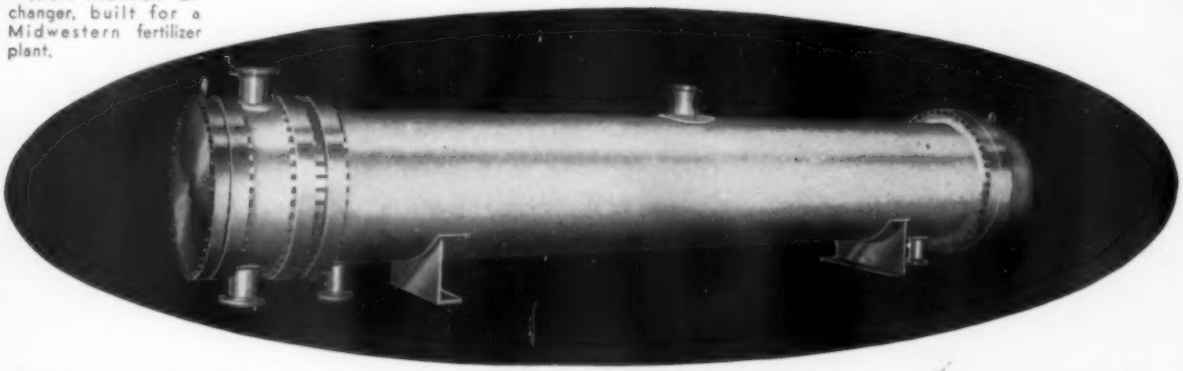


SPECIAL *Metallurgy*

ALUMINUM HEAT EXCHANGERS from WESTERN

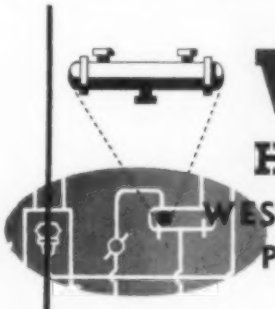
Preventing product contamination in a Gulf Coast high density polyethylene plant is the application for which these Western Aluminum Exchangers were designed.

Corrosion resistance to ammonium nitrate solutions is the job of this Western Aluminum Exchanger, built for a Midwestern fertilizer plant.



Exemplary of Western's experience in special alloy fabricating are these all-aluminum exchangers—wherein Western's metal inert gas and tungsten inert gas welding equipment, along with other specialized equipment and facilities—are utilized to produce heat exchangers specifically designed for handling specific corrosive fluids. Western's background in special metals has been successfully applied to Austenitic Stainless Steels —High Chrome Irons—Low Chrome Moly Steels— Monel—Copper Silicon—Nickel—and Aluminum.

You can profit from Western's extensive metallurgical experience. All we need is the opportunity.



WESTERN

HEAT EXCHANGERS

WESTERN SUPPLY COMPANY

P. O. Box 1888 – Tulsa, Oklahoma

Lighter! Tighter!

LUNCOR PVC VALVES

Defy Corrosion!

FIG. 2601
SOCKET END
125 WP—140° F.

FIG. 2600
SCREWED END
125 WP—140° F.

Replace expensive high-alloy or glass-lined valves in your corrosive services with these money-saving, high-performance valves. Luncor is the first all-molded PVC valve designed and engineered by a valve manufacturer . . . and its low-cost performance is proved in handling most common corrosive solutions. Luncor Valves weigh only half as much as aluminum—one-sixth as much as bronze. Yet their high strength-weight ratio gives them rigidity comparable to metal. Luncor Valves are available in one-half inch through two inch sizes.

To list only a few . . . Luncor PVC Valves have established outstanding records for economy and service in the following operations:

- PAPER MILLS
- CHEMICAL PLANTS
- FOOD PROCESSING
- BEVERAGE BOTTLING
- PETROLEUM REFINING
- SUGAR REFINING
- WATER TREATMENT
- MARINE INSTALLATIONS

For detailed service recommendations . . . request a *Confidential Corrosion Service Information Form* from your Lunkenheimer Distributor, or from The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.

BRONZE • IRON • STEEL • PVC

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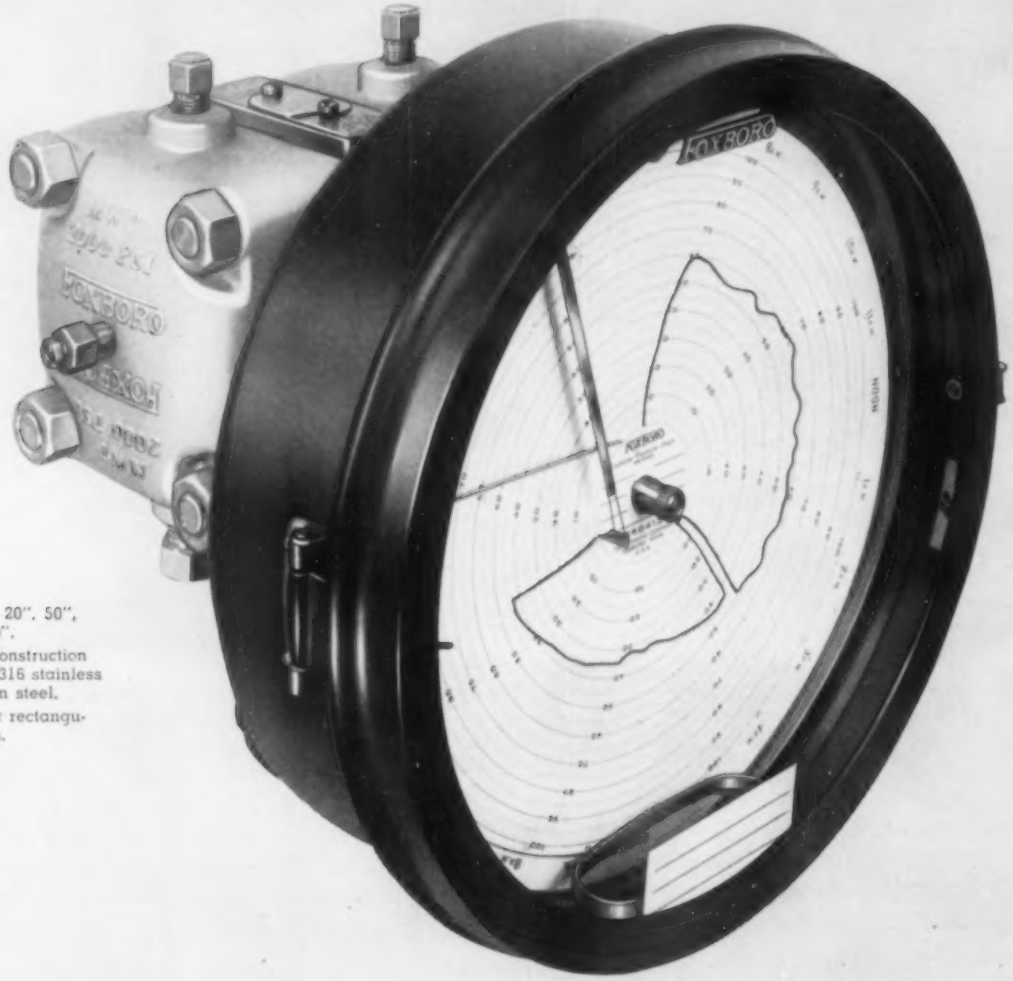
LUNKENHEIMER QUALITY

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

NOW... a "Dry" Flow Meter with ..

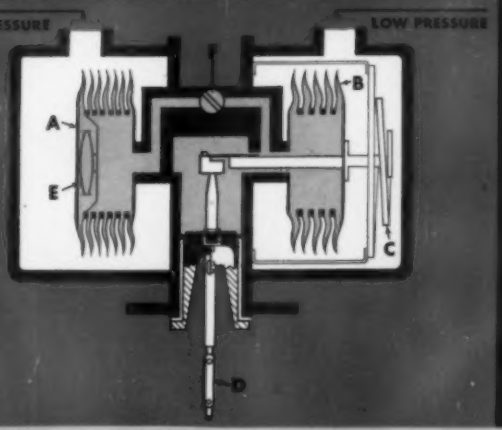


- Ranges: 20", 50", 100", 200".
- Forged construction in Type 316 stainless or barbon steel.
- Round or rectangular cases.

...the new Foxboro Type 37 Diaphragm Meter

How It Works

In schematic drawing at right, areas shown in color represent a stable, non-freezing liquid. Any pressure increase in the high pressure chamber compresses Diaphragm Unit A, displacing its liquid and expanding Diaphragm Unit B until force of Range Spring C equals the difference between the forces on Diaphragm Units A and B. Linear motion of Diaphragm Unit B moves inner end of Drive Bar D — outer end moves correspondingly through the bellows-sealed flexure bar, driving pen arm. Built-in Temperature Compensator (E) proportionately adjusts diaphragm capacity as ambient temperature variations affect volume of filling fluid. External damping adjustment is shown at F.



• complete overrange protection!

• sustained high accuracy!

Now you can have mercuryless flow measurement for a wide range of differential pressures — at static pressures up to 2000 psi — with greater safety and dependability than ever before! The new Foxboro Type 37 Diaphragm Meter not only combines unmatched ruggedness and precision in a dry meter — it's by far the easiest to adjust and maintain. And it does away with zero drift problems, once and for all! Expansible, Type 316 S.S. diaphragm elements respond to changes in pressure with unmatched sensitivity, yet are completely immune to overrange up to full static pressure! A unique packless drive bar precisely transmits linear motion to the pen arm. Range-changing is easy, due to new twin-spiral spring design. Wide range damping is externally adjustable under pressure. And the Type 37 is self-compensating for temperature changes in all differential ranges. Get full details on this high utility, completely dependable dry flow meter. Arrange for a demonstration with your nearby Foxboro Field Engineer, or write **The Foxboro Company, 609 Neponset Ave., Foxboro, Mass., U.S.A.**

FOXBORO
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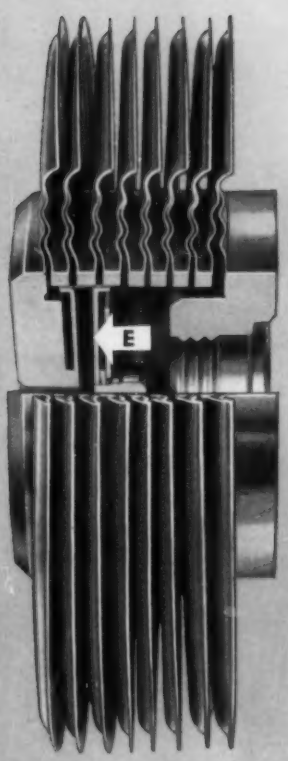
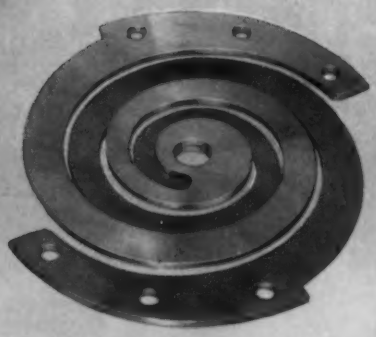
FIRST IN FLOW METERING



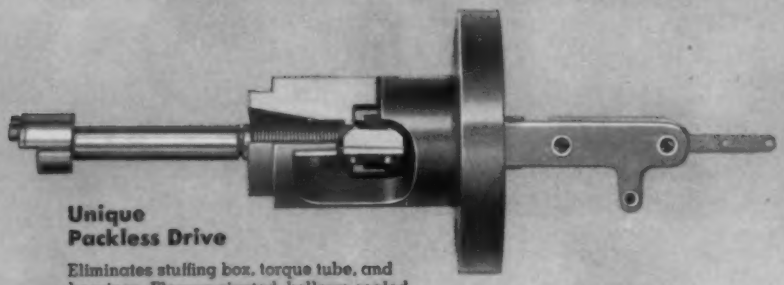
Exclusive Diaphragm Elements

Type 316 S.S. diaphragm units in both high and low pressure chambers provide greatest linearity and freedom from hysteresis; nesting design and integral spacer rings provide safe, positive, overrange protection. Temperature compensation (E) is built into diaphragm assembly . . . never requires change or adjustment.



Exclusive Range Springs

Heavy gauge Ni-Span C alloy, twin-spiral springs provide high sensitivity with lasting accuracy. Readily accessible . . . range changes are easily made, in minutes!

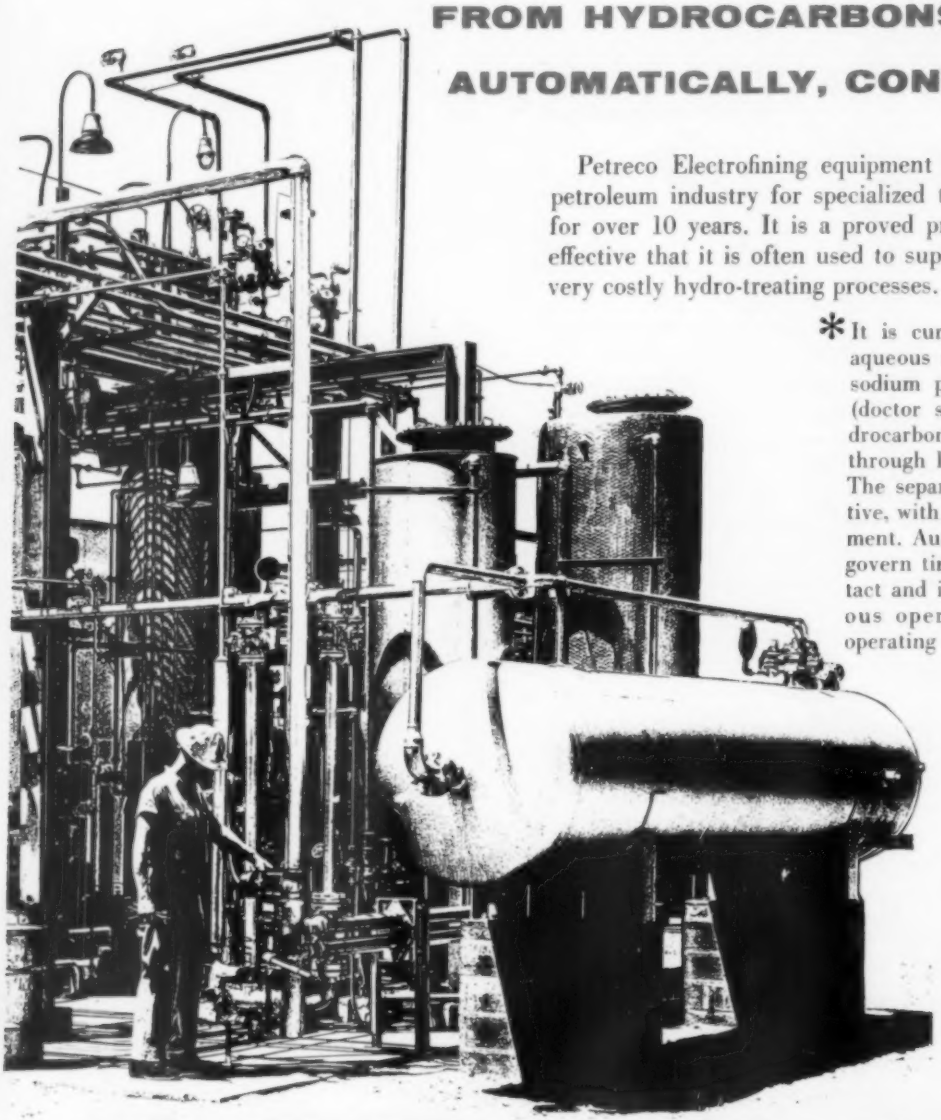


Unique Packless Drive

Eliminates stuffing box, torque tube, and bearings. Flexure-pivoted, bellows-sealed drive bar transmits diaphragm's linear motion to the pen arm with unequalled sensitivity *and undiminished* power. Seal for flexure pivot is a tough, flexible bellows.

do you have a separation problem?

PETRECO ELECTROFINING EQUIPMENT SEPARATES AQUEOUS-CHEMICAL SOLUTIONS* FROM HYDROCARBONS QUICKLY, AUTOMATICALLY, CONTINUOUSLY



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*It is currently used to separate aqueous solutions of acid, alkali, sodium plumbite-caustic solution (doctor solution) from light hydrocarbons ranging from gasoline through lubricating oil distillates. The separation is rapid and positive, with minimum or nil entrainment. Automatic, pre-set controls govern time and intensity of contact and insure efficient, continuous operation with minimum operating attention.

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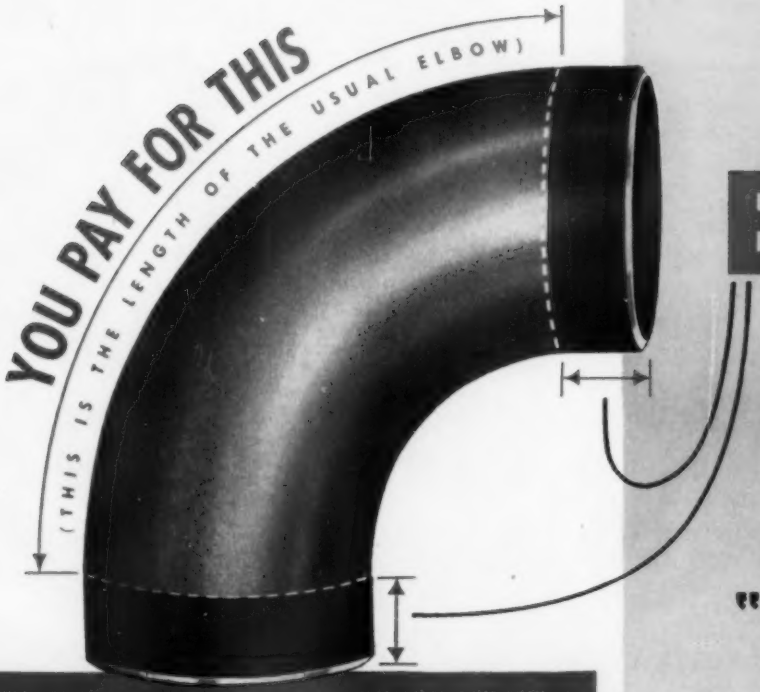

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WITH EVERY

MIDWEST

"LONG TANGENT" ELBOW

21% to 42% MORE ELBOW AT NO EXTRA COST

It's a built-in bonus that comes right with the elbow . . . a tangent or straight section at each end of the fitting.* Benefits of this bonus . . . this extra value . . . are yours AT NO EXTRA COST because Midwest "Long Tangent" Elbows are PRICED THE SAME AS OTHER ELBOWS. It's a value you can't afford to miss.

For additional information, ask your Midwest distributor or write us for Catalog 54.

*Size 24" and smaller have tangents equal to ¼ nominal pipe size; for example, 12" ell has 3" straight ends. Above 24" pipe size, all tangents are 6" long.

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- They save pipe.
- They often eliminate short nipples and their extra welds.
- They save time and money in lining up and clamping pipe and fitting.
- They make it easier to apply slip-on flanges.
- They remove the circumferential weld from point of maximum stress and can be sleeved.

THEY COST NO MORE THAN OTHER ELBOWS

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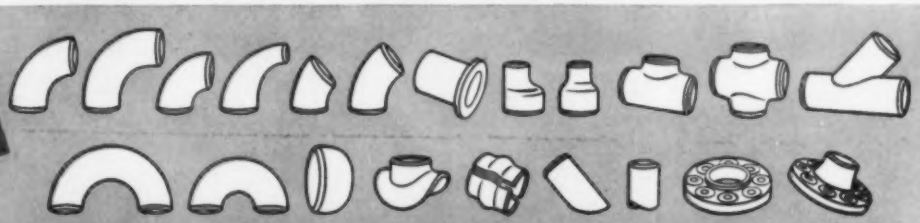
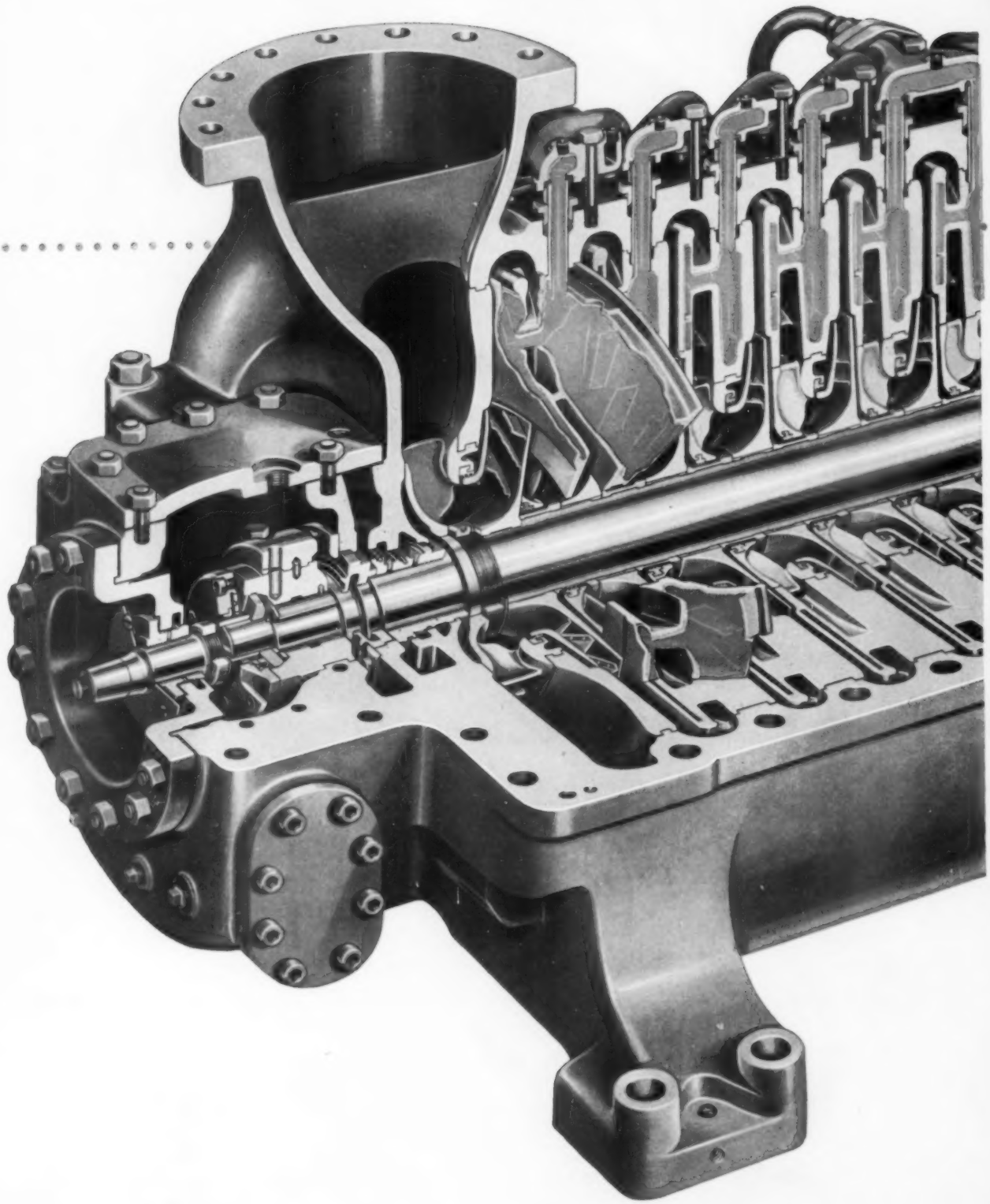
MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS





CLARK

Diaphragm Cooling

- **Minimizes polymer formation**
- **Slashes horsepower requirements**
- **Greater safety handling hazardous gases**
- **Reduces capital investment**

Clark double-wall diaphragm cooling is the simplest, safest, and most effective way to intercool a multi-stage centrifugal compressor. Furthermore, polymer formation is minimized in the compressing of unsaturated hydrocarbon gases by the use of diaphragm cooling. It is a simple, economical method of maintaining gas temperature at the desired level in the capacity range of 1,000-30,000 CFM.

Power savings are an additional benefit of diaphragm cooling. The savings range from 20% on 15 molecular weight vacuum gas compressing applications to 5% for 110 psig. air compressors. Reduced installation and operating costs result.

Minimum capital investment is realized another way. Applications involving high compression ratios such as gas recovery and 120 psig. or less air compressors can be handled in a single case.

Diaphragm cooling also assures maximum safety when compressing oxygen, acetylene, and other difficult gases. Internal surfaces are always cool. Danger from potential hot spots is highly remote.

Clark builds a complete line of multi-stage centrifugal compressors and in many instances a gas turbine to drive them. Your nearest Clark representative has all the facts.

CLARK BROS. CO. OLEAN, N. Y.

One of the Dresser Industries

Offices in Principal Cities Throughout the World

CLARK®

Centrifugal Compressors

Gas Turbines

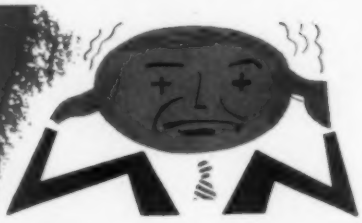
Have You a Special Heat Transfer or Chiller Problem?

My Problem Is Surface Fouling!

Vogt has the answer in the positive *flow-thru* Scraped Surface Exchanger. Surfaces are swept clean by the rotating scraper action, eliminating the headache of fouled heat transfer surfaces.

We Have A Tough Crystallization Problem!

Because Vogt Scraped Surface Exchangers maintain uniform heat transfer rates crystallization is under control at all times. The rotating blades free the crystals from the walls and they are discharged as a slurry.



Our Product Must Be Mixed As It Flows!

Chemical Processors are particularly happy with the Vogt Scraped Surface Exchanger, because the product is thoroughly mixed by the rotating scraper blades as it flows.

Our Solvents are Dangerous to Use - Expensive to Lose!

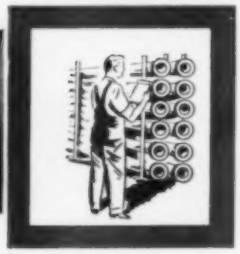
Vogt Scraped Surface Exchangers are closed, pressure-type systems which permit the use of flammable, volatile and expensive solvents with complete safety and no danger of solvent loss.

Vogt

Has the answer in its Scraped Surface Exchangers

Send for Bulletin PE-1 today. Address Dept. 24AR10.

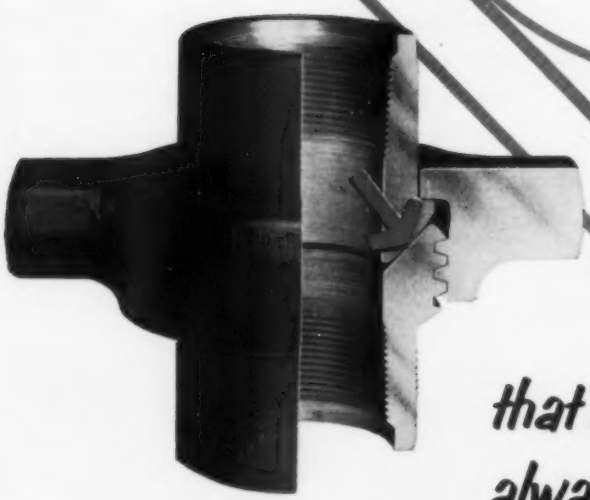
OTHER VOGT PRODUCTS: Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making and Refrigerating Equipment.



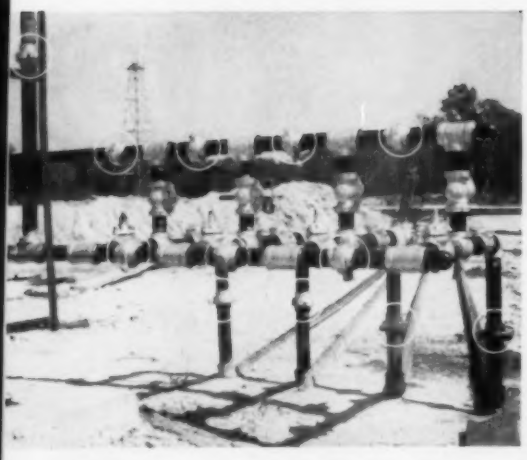
HENRY VOGT MACHINE CO., P. O. BOX 1918, LOUISVILLE 1, KY.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati, San Francisco

nothing SEALS like a ball... in a precision-ground seat...



that's why WECO unions always form PERFECT SEALS



Years of field service on the toughest jobs, with pressures ranging to 15,000 psi, afford positive proof that nothing seals better than the ball and cone design of WECO Unions. The spherical surface of the male sub always forms a perfect seal against the conical surface of the female sub, providing a secure metal-to-metal seal time after time; a seal that refuses to leak under high pressures, shock, surge or vibration.

WECO Unions are durable as well as efficient. They have stronger subs and wing nuts, heavier wall construction, and sturdy Acme threads. These factors all add up to unions that take the toughest treatment as a matter of course—and come back for more—on hook-up after hook-up.

WECO Unions are available in sizes from 1" through 12", pressures from 1,000 through 15,000 psi—at supply stores everywhere.

U-1-57

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HOUSTON, TEXAS

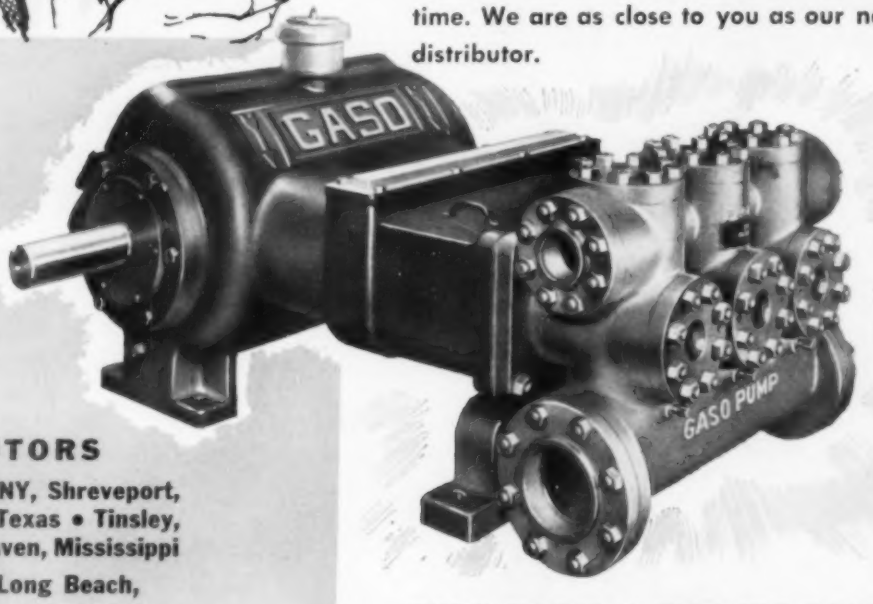
Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

Say GASO and R-e-l-a-x

HUNDREDS OF PIPELINE PEOPLE DO

No question, no doubt, no uncertainty when you specify GASO Pumps. Their 42-year record is relaxing assurance of everything you look for in pumps—adaptability to the job, capacity performance and low, low upkeep for unbelievably long periods of time. We are as close to you as our nearest distributor.



Newest member of the Gaso family—Fig. 3466 Horizontal Triplex Pump. A rugged 4" stroke high speed single acting plunger pump for moderate capacity, medium-to-high pressure service.

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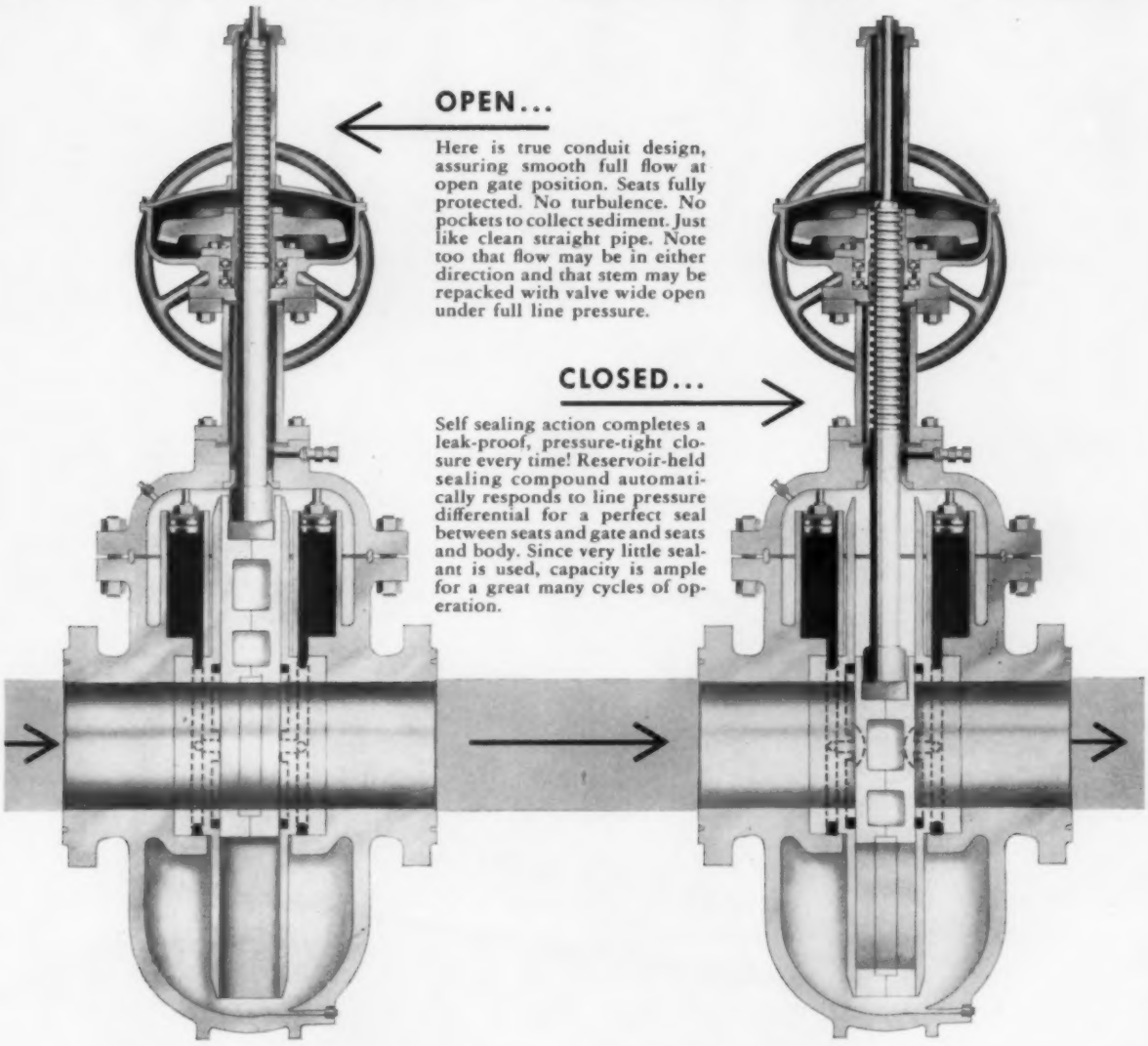
for every oil industry need

It's an "Open and Shut" case for...

DARLING-McEVOY CONDUIT GATE VALVES



OPEN...

Here is true conduit design, assuring smooth full flow at open gate position. Seats fully protected. No turbulence. No pockets to collect sediment. Just like clean straight pipe. Note too that flow may be in either direction and that stem may be repacked with valve wide open under full line pressure.

CLOSED...

Self sealing action completes a leak-proof, pressure-tight closure every time! Reservoir-held sealing compound automatically responds to line pressure differential for a perfect seal between seats and gate and seats and body. Since very little sealant is used, capacity is ample for a great many cycles of operation.

THESE and other features combine to make Darling-McEvoy conduit gate valves unique and unmatched in pipe line service today. They are now available in 4" and larger sizes, fully field proved, with experience a matter of record on various major lines. For detailed information ask for Bulletin 5402.

AUTHORIZED DARLING VALVES DISTRIBUTOR

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Hook onto real chain savings with REX® API CHAINS

Chain *isn't* the same. Not by a drilling site, it isn't. It takes special design features to put all the ruggedness into it that rig service demands.

There's your reason for Rex Balanced Design. This way, each chain component is balanced perfectly against the others—for greater strength, for added efficiency, for lasting performance. All parts are equally strong. Therefore, working load and stress are distributed over-all. No one part is singled out to do more than its share of the job. It's high-strength design without excess weight.

Rex builds greater wear resistance and long life into each part through careful attention to hardening, finishing and precision.

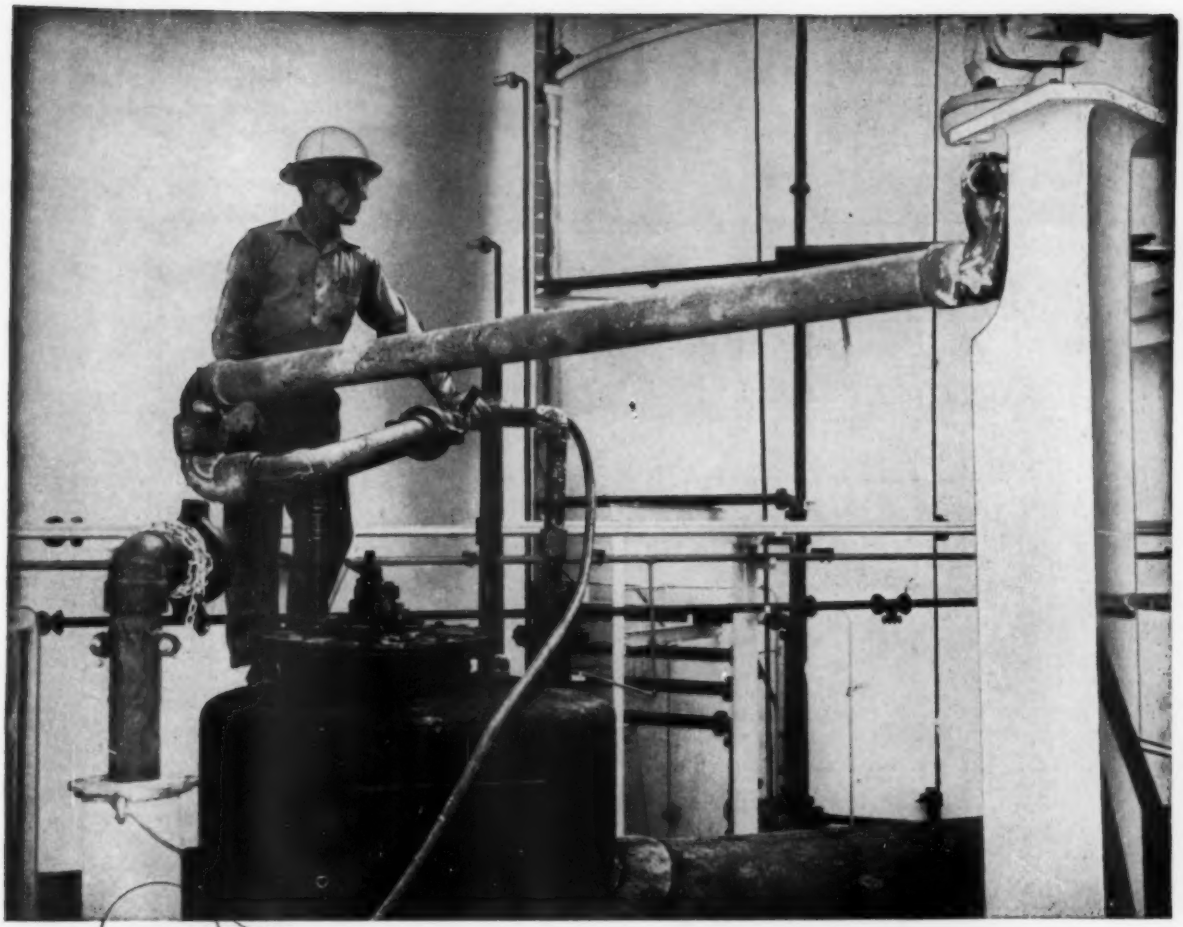
Another Rex API Chain advantage: unique 3-diameter pin speeds and simplifies assembly and disassembly—more chain working time, more money saved.

Keep drilling time up and chain costs down. Ask your supply store or Rex Field Sales Engineer about Rex API Chain. Or write for Catalog 55-3. CHAIN Belt Company, 4619 West Greenfield Avenue, Milwaukee 1, Wis.

CHAIN BELT COMPANY

Milwaukee 1, Wisconsin

Oil field district offices in: Dallas • Houston • Midland • Los Angeles • New York



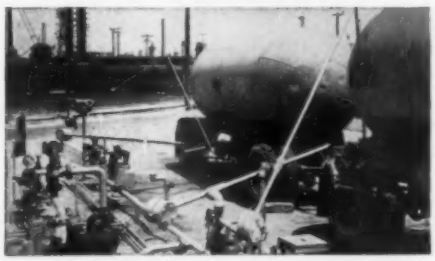
IN FLUID HANDLING—

CHIKSAN

LOADING ARMS

give hard-to-handle liquids a
SAFE SEND-OFF . . .

Chiksan Loading Arms, with their versatile ball-bearing swivel joints, combine unlimited flexibility with the safety and longevity of metal. With Chiksan there's never a problem of hazardous, often costly, line rupture loss. In fact, whatever fluid you are handling, you get longer life, spend less on maintenance, with Chiksan Loading Arms. Write for descriptive literature today.



Chiksan Loading Arms deal with hard-to-handle corrosive chemicals, hydrocarbons, and other fluids and gases, speedily and safely, in all kinds of weather.

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

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THE HAMMOND
DIALIFT

the only membrane type conservation tank

... with full-rated vapor and product capacity at all times

... with a membrane that cannot come in contact with product

... with vapor space that can be isolated for inspection and maintenance without taking tank out of service.

Principle of the Hammond Dialift

A—DIALIFT DIAPHRAGM rises and falls to accommodate expanding and contracting vapor.

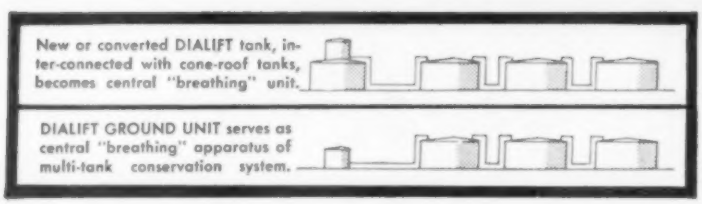
B—Vapor passes to and from tank and DIALIFT through simple elbow connection.

C—DIALIFT and tank have full-rated capacity.

D—Membrane can't come in contact with product.

E—DIALIFT can be isolated for maintenance and inspection, product tank stays in service.

The most efficient and economical vapor conservation system for new or old tanks.


New or converted DIALIFT tank, inter-connected with cone-roof tanks, becomes central "breathing" unit.
DIALIFT GROUND UNIT serves as central "breathing" apparatus of multi-tank conservation system.

THE HAMMOND DIALIFT consists of a gas-tight Vulcalock membrane attached to the inside periphery of a cylindrical metal housing to become a "breathing" apparatus to accommodate the expanding and contracting vapor as developed in product storage tanks. The DIALIFT can be used as a single conservation unit by being attached to the roof of a product storage tank or as a central "breathing" system by being manifolded to a number of product storage tanks. There are two forms of installation:—Ground type manifolded to a number of tanks to form a conservation system and integrated type whereby the DIALIFT is attached to the roof of a tank for vapor conservation for one or a number of tanks. The DIALIFT is completely isolated from the product storage tank. Vapor passes between the tank and DIALIFT through a vaporline connection. It is easy to convert old cone roof tanks to efficient vapor-saving DIALIFT installations by attaching a DIALIFT housing with membrane to the roof of the old tank and connecting the vaporline between the tank and DIALIFT.

THE HAMMOND DIALIFT ELIMINATES BREATHING LOSS AND REDUCES FILLING LOSS

Write for dialift catalog 55DL

HAMMOND IRON WORKS

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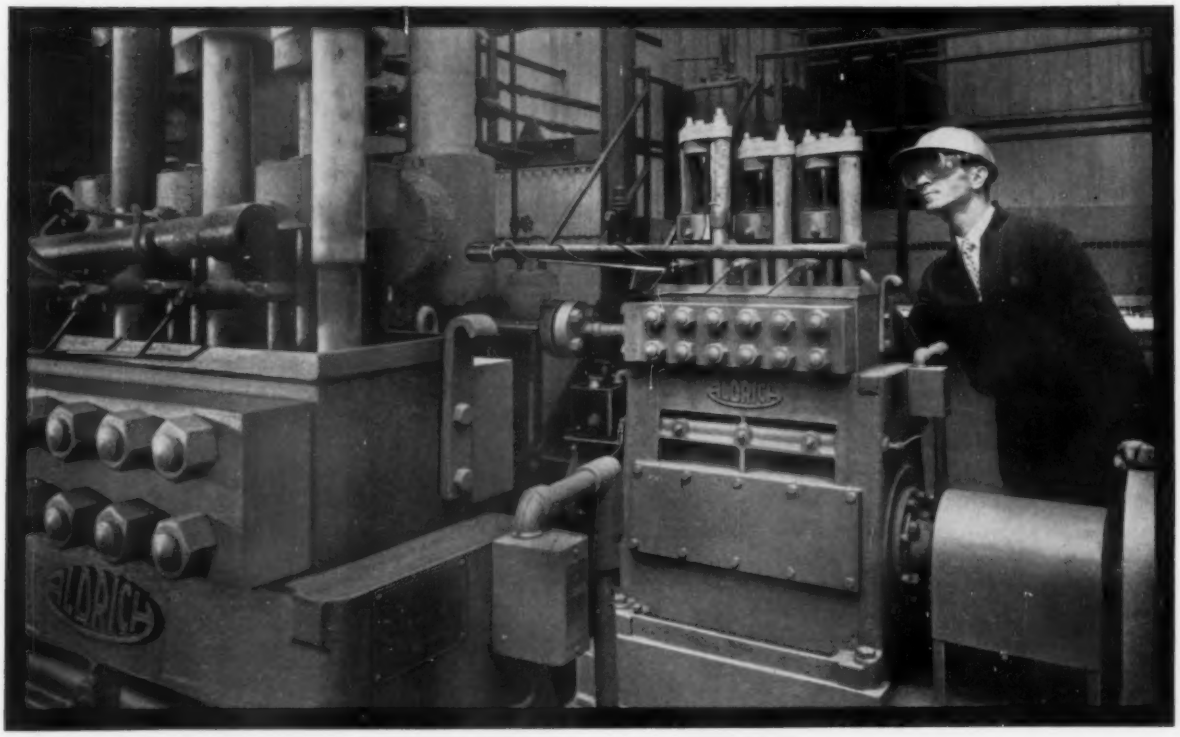
SPENCER CHEMICAL CO. UNRAVELS KNOTTY PROBLEM:

Maintaining a controlled flow of liquid ammonia at high pressures, 24 hours a day.

At the Vicksburg, Miss. plant of Spencer Chemical Company, ammonia production demands two things of pumps: (1) 24-hour, 7-day-week operation and (2) continuous flow of controlled volumes of liquid ammonia at high pressure.



How Spencer licked the problem: When Spencer began outlining construction plans in 1951, company engineers specified two Aldrich Direct Flow, ¾" x 3" stroke Triplex Pumps. These were scheduled to be used for alternate 30-day periods. According to company spokesmen, nearly four years of service have proved these pumps to be efficient and capable of durable service.

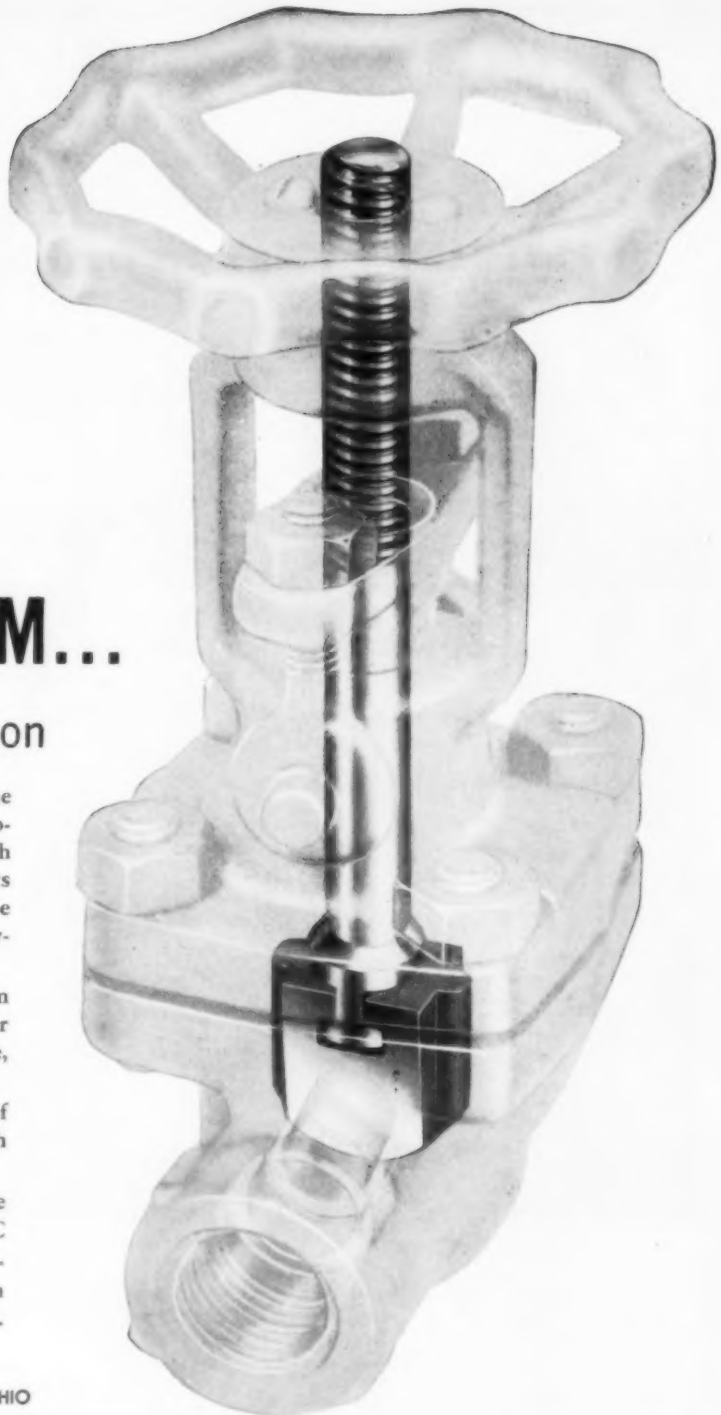
Results: Dependability and freedom from trouble in all phases of operation. The Vicksburg Works Maintenance Superintendent tells us: "The Aldrich Pump is an excellent unit. Valve life is excellent and packing life exceptionally good."

We'll be glad to send you full information on Aldrich Pumps and their advantages to you. Simply write Aldrich Pump Company, 9 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

1000 BRINELL DURACASE TRIM...

Stops galling and erosion



Since the introduction of OIC's Duracase Trim, many forged steel valve specs are obsolete. This 13% chrome stainless steel trim with 1000 Brinell, case-hardened wedges and discs assures positive protection against even the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling.

OIC offers you a choice of two modern body-bonnet connections—union ring or bolted bonnet—on its entire forged steel gate, globe, angle, and check valve line.

In addition, gate valves offer a choice of standard-flow or high-flow body ports, both with 1000 Brinell wedges.

Step up your valve requirements to the modern high-quality standards reflected in OIC valves. Include OIC on your next specification.

For OIC forged steel valve specification literature, write for Forms No. 195 and 195-R.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

MILES PER HOUR	ENGINE REVOLUTIONS PER HOUR		
	IN CONVENTIONAL AXLE HIGH	IN EATON AXLE HIGH-HIGH	SAVED
10	37480	33995	3485
20	74960	67990	6970
30	112440	101985	10455
40	149920	135980	13940
50	187400	169975	17425

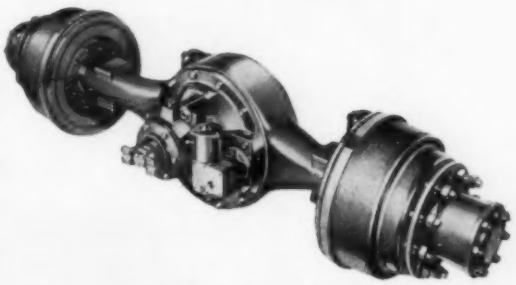
Based on most popular axle ratios and tire size.

EATON 2-Speed Axles Cut Down "Revolutions per Mile"

Save Operating and Maintenance Costs—Make Trucks Last Longer!

The chart above shows the big reduction in engine revolutions made by Eaton 2-Speed Axles in high-high gear ratio. Fewer Revolutions per Mile mean reduced piston travel, less wear on every rotating engine part and power transmitting unit.

Not only when highballing on the open highway—but in every hauling situation—pulling out of the hole under full load, climbing steep grades, maneuvering in city traffic—Eaton 2-Speeds save wear and tear on engines by permitting them to operate in their most economical speed range. This results in important savings in operating and maintenance costs, thousands of extra miles between engine overhauls, fewer interruptions of operation, and more miles in the life of the truck.



More than Two Million Eaton Axles in Trucks Today. For complete information, see your truck dealer.

EATON — *AXLE DIVISION*
MANUFACTURING COMPANY
CLEVELAND, OHIO

PRODUCTS: Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioners Fastening Devices • Cold Drawn Steel • Stampings • Gears • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

...more quality proved POWELL VALVES

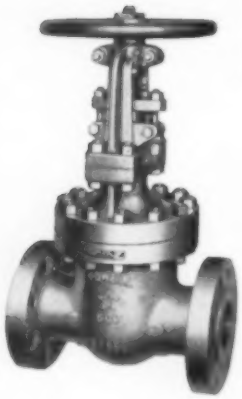


FIG. 6003 SS—Alloy Steel Gate Valve for 600 Pounds W.S.P.

FIG. 3061—300-Pound Steel Swing Check Valve.

FIG. 1563G—Gear Operated Lubricated Plug Valve, 150 Pound Steel.

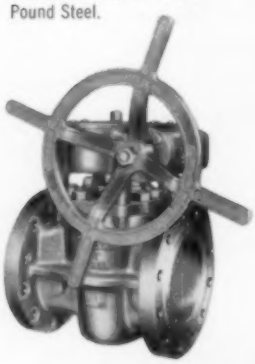
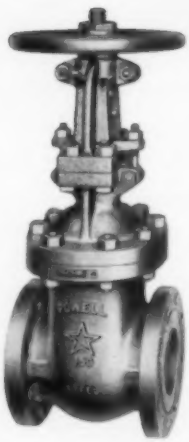


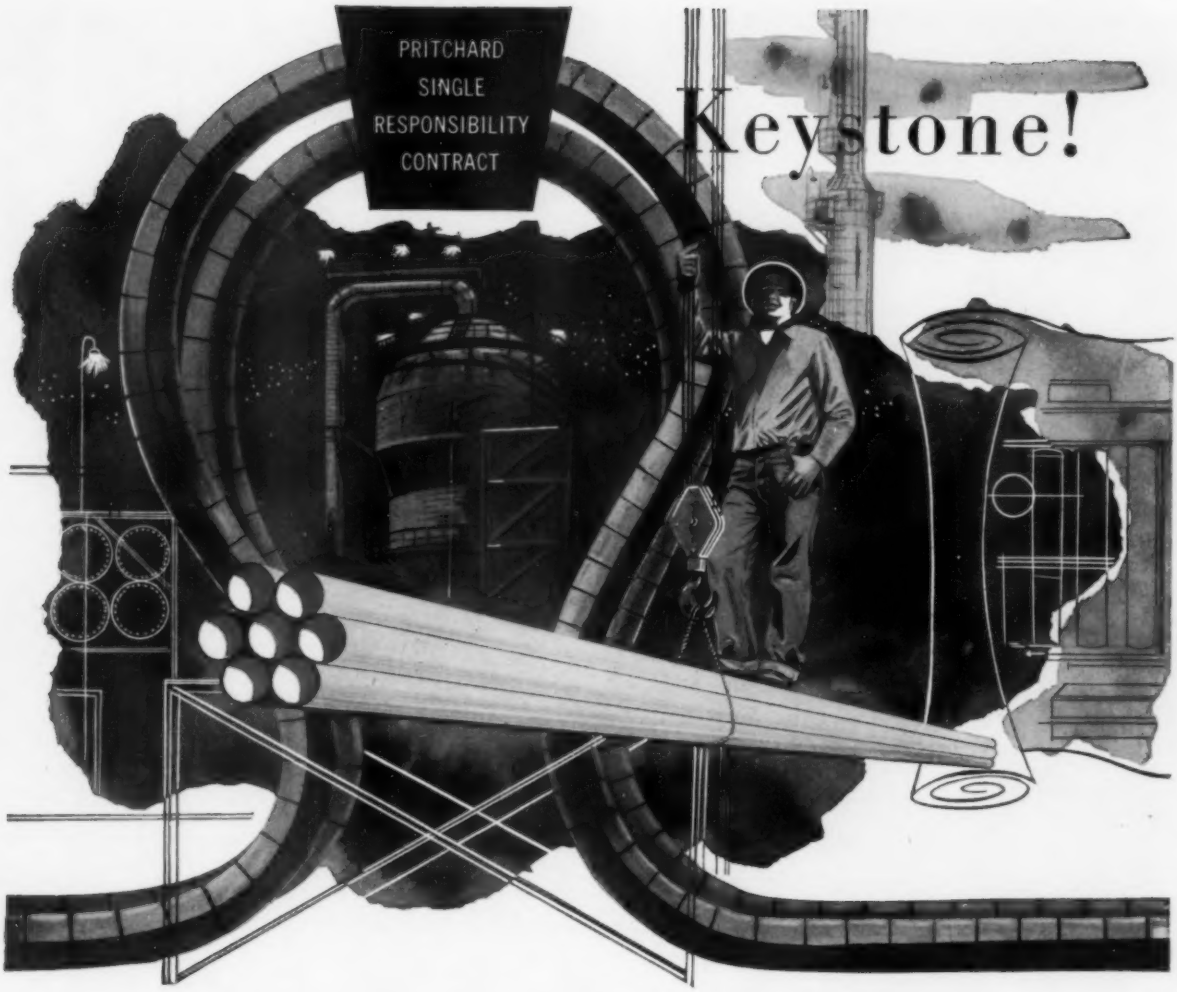
FIG. 1503—150-Pound Steel Gate Valve.



Designed for long life, designed for dependable service

Consult your Powell Valve distributor for all the facts about quality proved bronze, iron, steel and corrosion-resistant valves. For every flow problem . . . there is a Powell Valve to solve it.

THE WM. POWELL COMPANY, CINCINNATI 22, OHIO . . . 111th YEAR



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You will find, as have many other companies in the petroleum and gas industries, that a Pritchard Single Responsibility Contract is the Keystone to a successfully completed construction, modernization or expansion project. And such a contract can be much more profitable to your company by saving time and money. Here's how.

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PRITCHARD GUARANTEES PERFORMANCE... good engineering is the basic attribute of a successfully completed contract. From Pritchard you get unmatched engineering service without paying a premium price. Performance of every project is guaranteed.

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KEY Fittings have many distinct advantages, including simple design for easier maintenance and repair, fewer parts for less inventory and cost, rugged construction of any desired alloy for long life and safety, ample corrosion allowance, streamlined crossover port for minimum pressure drop and turbulence.

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Serve Socony Mobil Paulsboro Refinery

The heater in this modern refinery is equipped with new patented **KEY** 5000 type return bend fittings. Leading refineries everywhere use these fittings because they offer dependable and lasting service with real economy.

Our Bulletin No. KR-1057 contains complete details about the full line of **KEY** 5000 type fittings. Write now for your free copy.

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W-K-M

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MANUFACTURERS OF W-K-M GATE VALVES · ACF LUBRICATED PLUG VALVES · KEY-KAST ALLOY STEEL PIPING FITTINGS · KEY RETURN BENDS AND FITTINGS

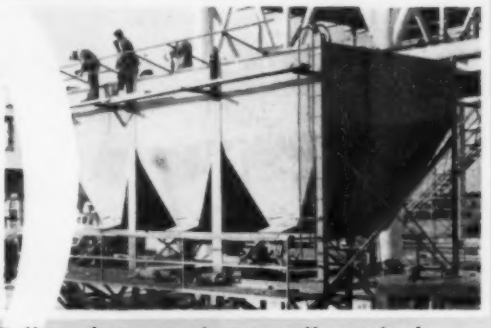
Delta Tank Storage Bins for Drilling Muds and Cement...

Do the Job!

Bulk storage plant next to rail siding.

Bulk mud storage on barge.

Custom-built storage within a drilling tender.



Bulk mud storage plant on self-contained drilling platform.

The handling and storage of bulk drilling mud and cement is a specialty with Delta.

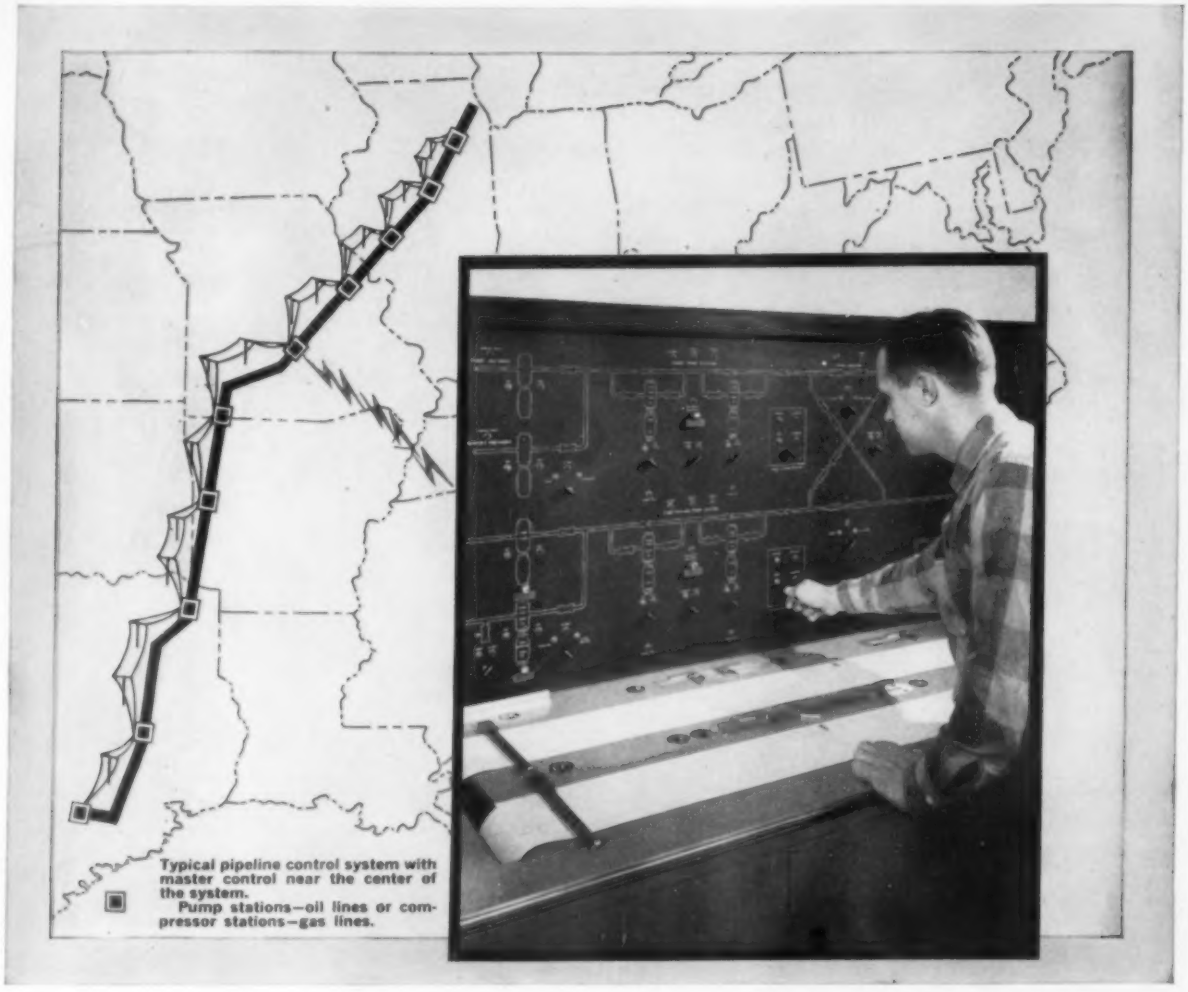
Working closely with the mud and cement industries, Delta engineers pioneered in the research and development of facilities specifically adapted to offshore drilling operations.

Delta Materials Handling Equipment provides the maximum of storage, constant and controlled distribution. On land or sea . . . portable or stationary, Delta systems do the job. *ASK THE DELTA MAN!*

DELTA TANK MANUFACTURING COMPANY, INC.

BATON ROUGE, LOUISIANA

PLANTS: BATON ROUGE, LA. • MACON, GA. • BEARDSTOWN, ILL.
EXPORT OFFICE: INTERNATIONAL TRADE MART, NEW ORLEANS, LOUISIANA
FABRICATORS OF OIL FIELD EQUIPMENT, MATERIAL HANDLING EQUIPMENT, AND PRESSURE VESSELS.



Typical pipeline control system with master control near the center of the system.
Pump stations—oil lines or compressor stations—gas lines.

UNION CTC means a complete Centralized Transport Control System

When you want a *complete* pipeline control system of any desired length, specify UNION CTC. Our engineering is based on the *systems design approach*, and Union Switch & Signal is prepared to take responsibility for integrating the entire control system. This includes communications, instrumentation, telemetering, and sequence control integrated into the one CTC system.

An operator located at a central dispatching office has all the information needed to control the flow of oil or gas throughout the system. He can function as if he were actually present at each station under his supervision. Control and indication codes can be transmitted over one pair of line wires or other channel in seconds.

UNION CTC provides more efficient dispatching and more effective control of through-put with considerable reduction in operating costs. It is *not* an expensive luxury . . . it is a profit earner.

If you are planning a new pipeline or modernizing an old one, Centralized Transport Control offers definite advantages. It can be used for gathering systems, tank farms and offshore applications. Write for our Bulletin No. 1052.

UNION SWITCH & SIGNAL
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY
PITTSBURGH 18, PENNSYLVANIA

Quality First
. . . TO LAST

Employment Office for HEAT...

Do you have a source of waste heat... from still bottoms, intermediate fractions, process liquids, or exhaust steam... that is not being put to useful work?

If so, refer the matter to the G-R Employment Office For Heat. This "employment agency" has found well-paying jobs for waste heat in refineries all over the country... to preheat incoming fluids, to heat other liquids, air, or gases, and to generate steam. G-R heat exchanger designs have successfully recovered heat even from tarry and dirty materials that have clogged previously used units, and they are materially reducing fuel costs and improving plant processes in many hundreds of refineries.

Your inquiry will receive prompt attention from the G-R engineers who have long specialized in solving heat transfer problems of every conceivable kind. Write for advice and specific recommendations on *your* waste heat problem.

THE GRISCOM-RUSSELL COMPANY

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

MASSILLON, OHIO

Griscom-Russell

HEAT TRANSFER APPARATUS

GR-571

"Can you furnish an efficient heat exchanger for 2 fluids of different transfer rates?"

"I need a stock design of heat exchanger for quick shipment."

"Is it possible to get a heat exchanger with fins and tubes of different materials?"

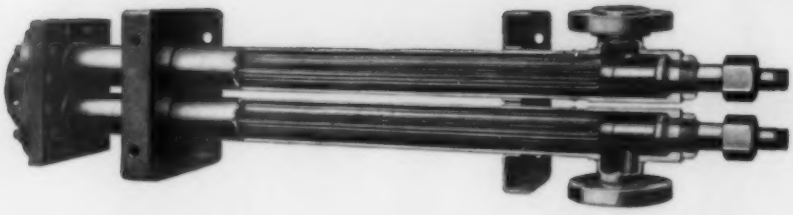
"Do you have a standardized heat exchanger that can be used for a variety of services?"

"I want a heater system that will require least spare units."

FIVE QUESTIONS

One Answer...

THE G-R TWIN G-FIN SECTION



Yes, this "Universal Heat Exchanger" meets all these needs . . . and many more. It actually has the widest range of heating, cooling, condensing and heat exchange applications of any heat transfer apparatus on the market. • The G-R Twin G-Fin Section has proved its effective design and durable construction through 25 years of service. • This unit is the simplest type of heat exchanger, easy to install, economical to maintain, and with high salvage value because of its standardized design. Write for bulletin describing the many Twin G-Fin Section advantages in detail.

THE GRISCOM-RUSSELL CO.

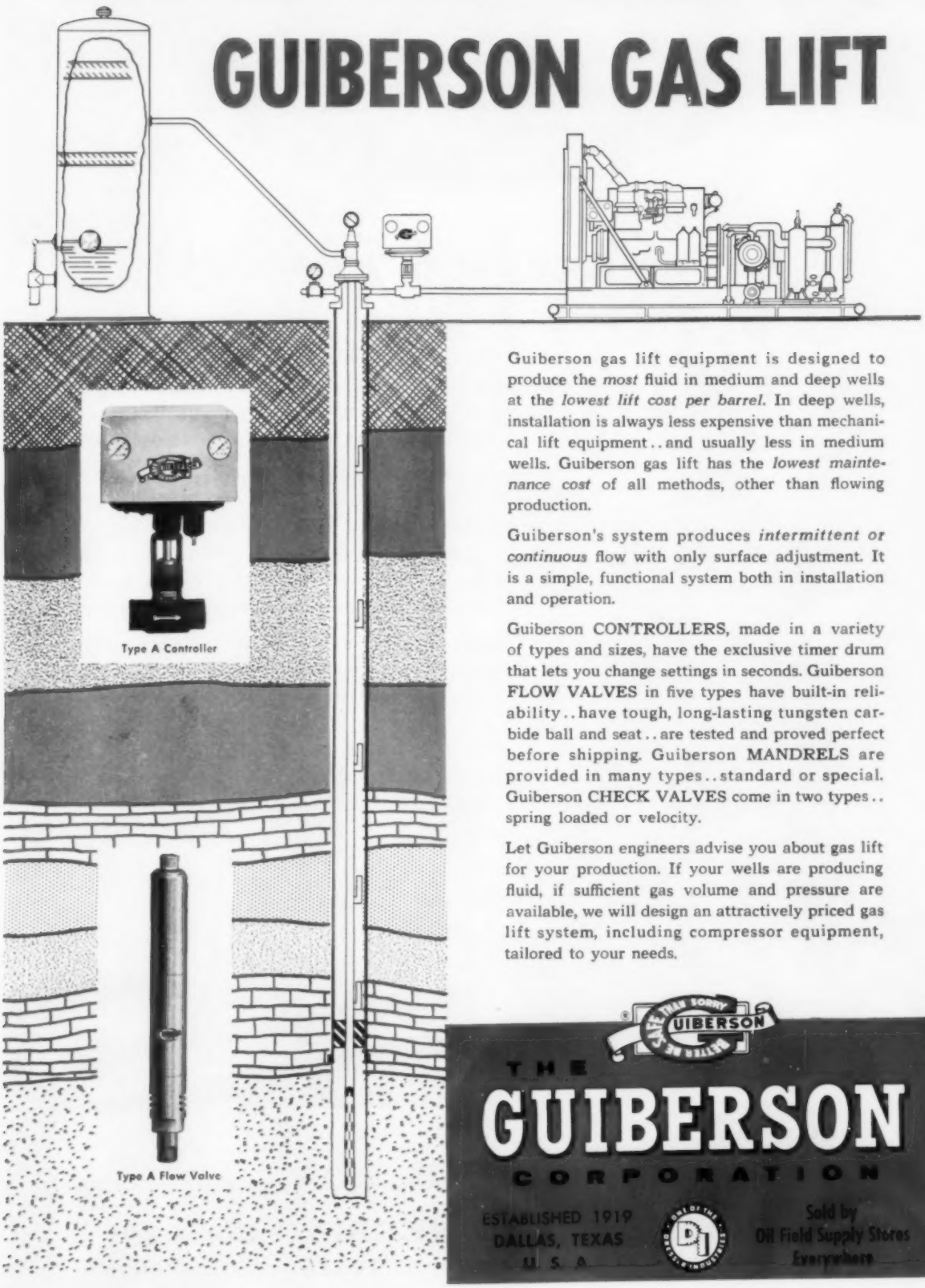
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

MASSILLON, OHIO

GR-374

When Flow Is Slow.. It's Time For

GUIBERSON GAS LIFT



Guiberson gas lift equipment is designed to produce the *most* fluid in medium and deep wells at the *lowest lift cost per barrel.* In deep wells, installation is always less expensive than mechanical lift equipment.. and usually less in medium wells. Guiberson gas lift has the *lowest maintenance cost* of all methods, other than flowing production.

Guiberson's system produces *intermittent or continuous* flow with only surface adjustment. It is a simple, functional system both in installation and operation.

Guiberson **CONTROLLERS,** made in a variety of types and sizes, have the exclusive timer drum that lets you change settings in seconds. Guiberson **FLOW VALVES** in five types have built-in reliability.. have tough, long-lasting tungsten carbide ball and seat.. are tested and proved perfect before shipping. Guiberson **MANDRELS** are provided in many types.. standard or special. Guiberson **CHECK VALVES** come in two types.. spring loaded or velocity.

Let Guiberson engineers advise you about gas lift for your production. If your wells are producing fluid, if sufficient gas volume and pressure are available, we will design an attractively priced gas lift system, including compressor equipment, tailored to your needs.

CAN'T BE SORRY — GUIBERSON — BETTER BE

THE

GUIBERSON

CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

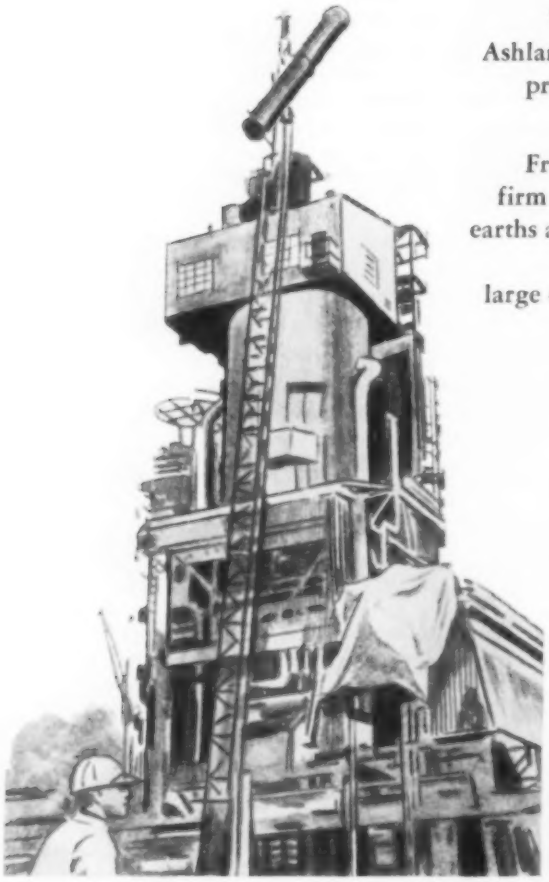
ONE OF THE DRESSER INDUSTRIES

Sold by
Oil Field Supply Stores
Everywhere

1942 TRECO 1957

15th ANNIVERSARY

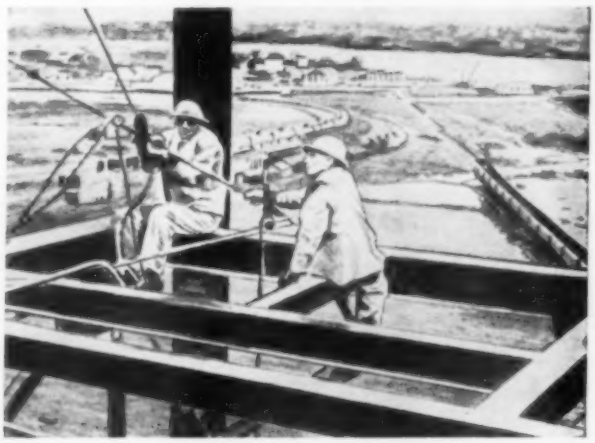
15 Years of Progress



TRECO'S first job in 1942 was a small contract from Ashland Oil Refining Company of Ashland, Kentucky. The prompt and efficient execution of this contract brought several more as each preceding one was completed.

From this small beginning in the refining industry, our firm has expanded into the fields of petro-chemicals, rare earths and ores. Our staff has continued to expand as have the areas of our operations until today, no job is too large or too far from our home base. Every contract receives the same prompt and efficient execution as our first.

Now, on our 15th Anniversary, we are most grateful to those companies whose first contracts played such an important part in our operations.



TRECO

A DIVISION of VITRO CORPORATION of AMERICA

The REFINERY ENGINEERING Company

NEW YORK TULSA TORONTO

What do you want in WELDING FITTINGS?

For any welded piping job you want fittings that fit — no disgusting last-minute complications.

You want fittings made of materials that measure up to your specifications — no mysterious failures.

You want a source for special as well as regular fittings. You want to avoid unnecessary welds, makeshift expedients, clumsy combinations.

You want to avoid procurement ordeals — the business of trying to make yourself understood. You want to do business with alert men who speak your language — engineers if you need them.

And — you want to know your business is appreciated.

The best answer to your welding-fittings wants, of course, is in your nearby J&L Supply store.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

27-G

announcing new #5-S* INHIBITOR

5 ways better!

1 MOST POTENT of all gasoline antioxidants. Absolute protection from gum formation and TEL decomposition in stored gasolines.

2 MOST VERSATILE inhibitor-sweetener. Handles even gasolines formerly considered "impossible."

3 MOST RAPID sweetening action. *One-fourth to three-fourths faster* oxidation of malodorous mercaptans means a more flexible operation, less storage equipment needed.

4 MOST PROTECTION against engine deposits because phenylene diamine type eliminates their primary cause, gum formation.

5 MOST ECONOMICAL. *Five* molecules of UOP #5-S protect and sweeten a *million* molecules of gasoline . . . a cost of less than ½¢ per bbl.

Universal Oil Products Company has pioneered in the development of products and methods for better, more economical gasoline finishing. If you have a stability or quality problem, drop us a line and we'll be glad to help you to a solution.

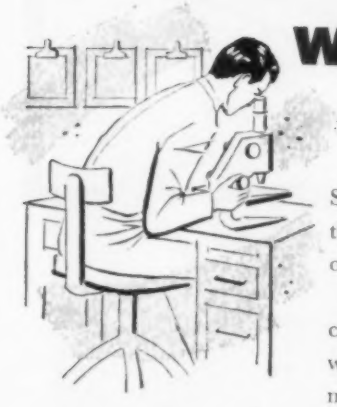
*Trademark

Products Department
UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U.S.A.

Microscopic Enemies?

Magnification 800X

Layne Research Defends Your Well Water Supply



Shown here is an actual photograph of one of the many microscopic organisms which may occur in any type water supply.

Layne Research is called upon when well capacity is reduced. Layne Research finds out why. Production records, water analysis and microscopic examinations are some of the methods used to find the reason. Layne Research, thru years of experience in "recovering lost water," selects the correct Laynite material and method to restore well capacity.

IDENTIFY AND PRESCRIBE — that's what Layne Research does for each individual well water problem.

Only Layne Offers Complete Service: *Research* • *Analysis* • *Design* • *Wells* • *Pumps* • *Maintenance* • *Engineering*

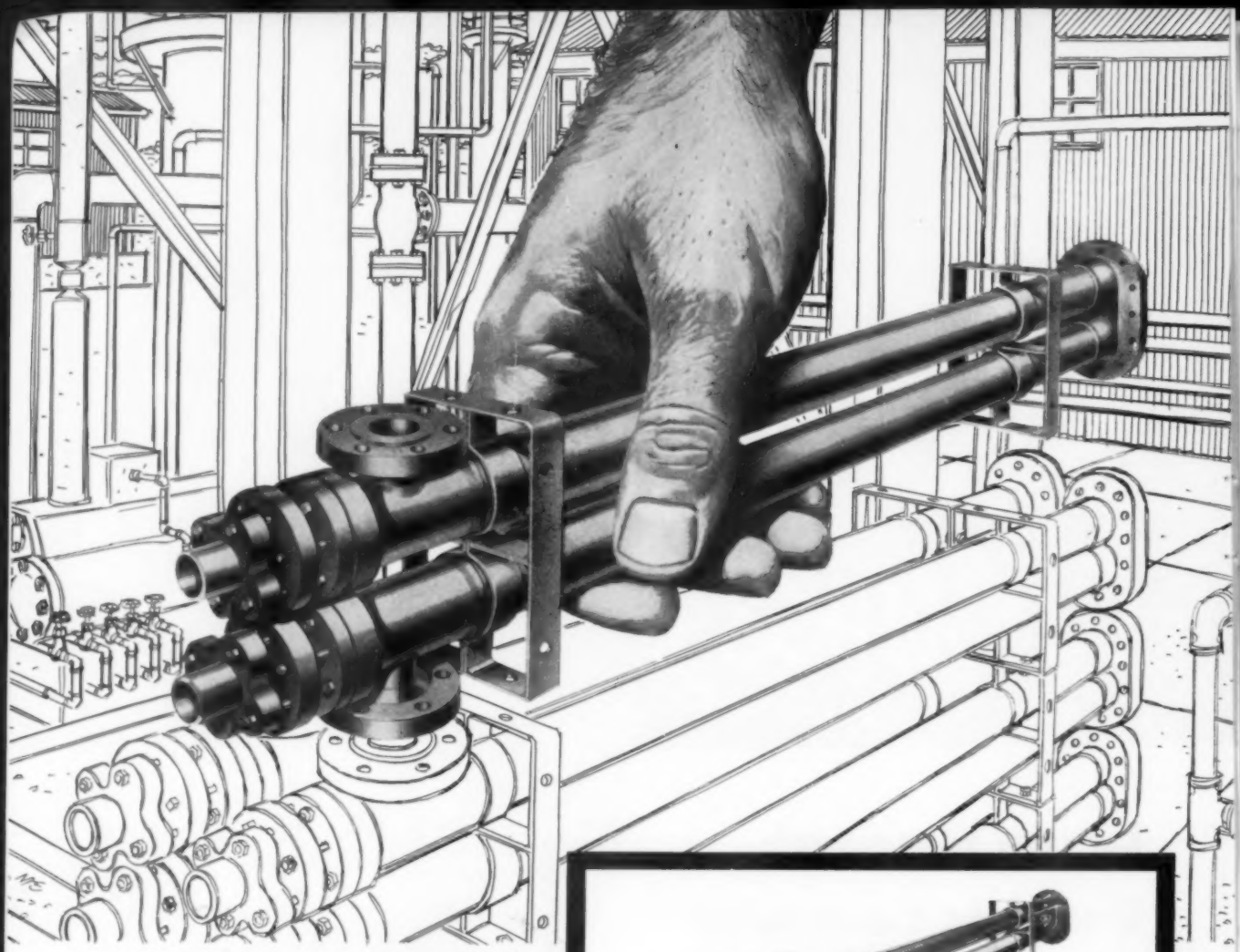
1882 — 1957 Layne 75 YEARS OF PROGRESS

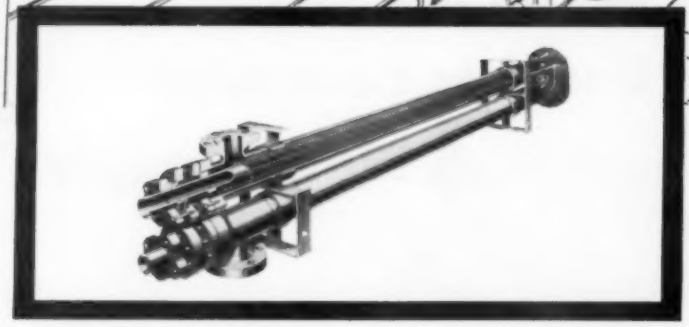
WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

LAYNE & BOWLER, INC. MEMPHIS

General Offices and Factory • Memphis 8, Tennessee

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD





ALCOTWIN® Heat Exchanger

has building block flexibility

The ALCOTWIN's flexibility means that you can change load or processes within your plant, and still use the same heat-exchange equipment. ALCOTWINS can be easily added for increased load, rearranged for changing processes. They never become obsolete because of their unlimited number of applications. Further, ALCOTWINS are readily available. You can buy them "off the shelf" at ALCO's Beaumont, Texas, plant.

The ALCO gas shielded tungsten arc welding method of fusing the fins to the tube permits the widest possible range of metallurgy. The precise metallurgy needed for optimum results in your application can be selected in an ALCOTWIN. The many combinations of tube and fin materials available mean more efficient performance in high temperature services.

The ALCOTWIN furnishes real economy in first cost, in ease of installation and maintenance, and later on their unlimited adaptability prevents obsolescence, keeps your ALCOTWINS on the job.

Complete information is available from any of ALCO's sales offices. For a copy of Bulletin FH-3 write Petroleum Industry Equipment Division, Dept. AW-1, P. O. Box 1065, Schenectady 1, N. Y.

ALCO

ALCO PRODUCTS, INC.

NEW YORK,

Sales Offices in Principal Cities

if you refine oil... and answer FIND YOUR REFINERY PROBLEM HERE

There are Tretolite Company products and services to help your refinery operate more smoothly, stay on stream longer, reduce operating costs and market better products. Here are a few of the problems they are helping to solve in other refineries every day:

PROBLEM	TRETOLITE PRODUCT	APPLICATION
Salty Crude	Tretolite Desalting	Crude Charge
Corrosion	Kontol Corrosion Inhibitors	Internal Piping, Refinery Equipment
Tank Bottoms	Tretolite Demulsifiers	Storage Tank Settlings
Waste Oil	Tretolite Water De-Oilers	Waste Oil Separators
Product Emulsions	Tretolite Fuel Emulsion Preventives	Burning Oils and Diesel Fuels
Copper Contamination	Kuplex Metal Deactivator	Gasoline, Kerosene, Jet Fuel, Diesel Oil, Burning Oil

The Tretolite Company Refinery Service Department is always available to assist you in any refinery problem. There is no charge or obligation for consultation or advisory service. Just ask your Tretolite Refinery Service Engineer...

THE MAN IN THE RED CAR

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A DIVISION OF PETROLITE CORPORATION

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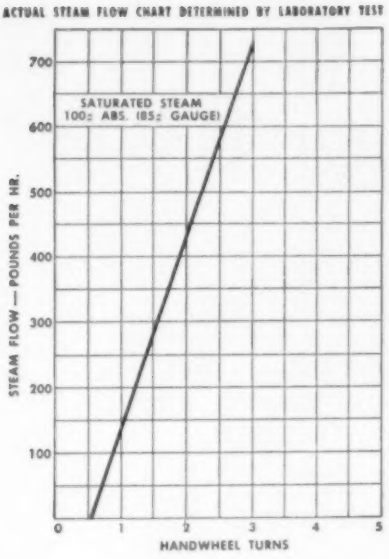
Chemicals and Services for the Petroleum Industry

DESALTING • DEMULSIFYING • CORROSION INHIBITING • SCALE PREVENTING • FUEL OIL ADDITIVES • WATER DE-OILING • METAL DEACTIVATORS



HANCOCK "Flocontrol®" VALVES

- ✓ **Insure Uniform Quality Through Closer Control**
- ✓ **Save Steam and Fuel on Process Work**
- ✓ **Save Money by Cutting Maintenance**

Hancock "Flocontrol" Valves provide a 3-in-1 design that combines variable orifice, shut-off and index. The valve opening can be set to within one-tenth of a turn of the handwheel. The micrometer dial and pointer make it easy to duplicate any desired setting instantly.

Each valve has a scientifically designed V-port valve disc that insures proportional flow throughout the entire lift of the stem. Straight line flow with separate shut-off seating surface removed from the controlling V-ports eliminates the need for a separate shut-off valve.

Hancock "Flocontrol" Valves are available in Bronze and Steel to meet specific requirements. All are rugged valves, designed and constructed to provide the *economy of quality* so essential to assure top performance in the most demanding services.

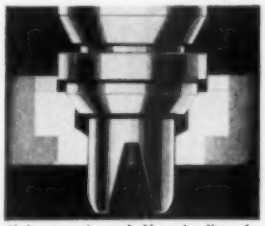
Hancock Bronze "Flocontrol" Valves. *Types:* Globe and Angle. *Sizes:* ¼" through 2". *Connections:* Screwed Ends. "500 Brinell" Stainless Steel Seats and Discs. 150# Series for all pressures up to 150 psi at 358° F. 300# Series for all pressures up to 300 psi at 550° F.

Hancock Forged Steel "Flocontrol" Valves. *Types:* Globe and Angle. Renewable Hard-Faced Stainless Steel Seats. "500 Brinell" Stainless Steel Discs. *Connections:* Screwed, Socket Weld and Flanged Ends. *Sizes:* Screwed and Socket Weld Valves—¼" through 2". Flanged Valves—½" through 2". *Screwed and Socket Weld Valves:* For all pressures up to 600 psi at 910° F. O.W.G.—2000 psi at 100° F. *Flanged Valves:* For all pressures up to 600 psi at 850° F. O.W.G.—1440 psi at 100° F.

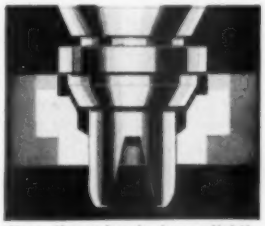
Hancock Cast Steel "Flocontrol" Valves. Globe Type with Screwed Bonnet. Renewable Stainless Steel Plug Seats and Discs. *Sizes:* 2½" and 3". *Connections:* Screwed and Flanged Ends. For all pressures up to 395 psi at 775° F. O.W.G. —720 psi at 100° F.

Hancock Cast Steel "Flocontrol" Valves. Globe type with Bolted Bonnet. Renewable Stainless Steel Plug Seats and Discs. *Sizes:* 2½", 3" and 4". *Connections:* Flanged Ends. 300# Series for all pressures up to 395 psi at 775° F. O.W.G.—720 psi at 100°F. 600# Series for all pressures up to 800 psi at 775° F. O.W.G.—1440 psi at 100° F.

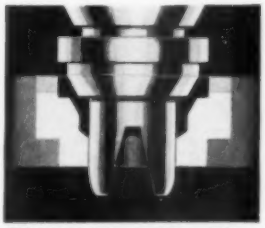
HANCOCK "FLOCONTROL" VALVES OPERATE LIKE THIS . . .



Valve seat and V-port disc in fully closed position. Pressure pushes upward under the disc. Note that the shut-off seating surface is completely removed and separate from the flow-controlling V-ports.



Here the valve is in a slightly opened position. The V-port disc is permitting a measured flow of the media.



This is the intermediate position. Note that the V-port disc now permits a proportionally greater flow of the media.

Fully opened valve provides maximum flow. The special micrometer dial and pointer permit any open position to be duplicated accurately.

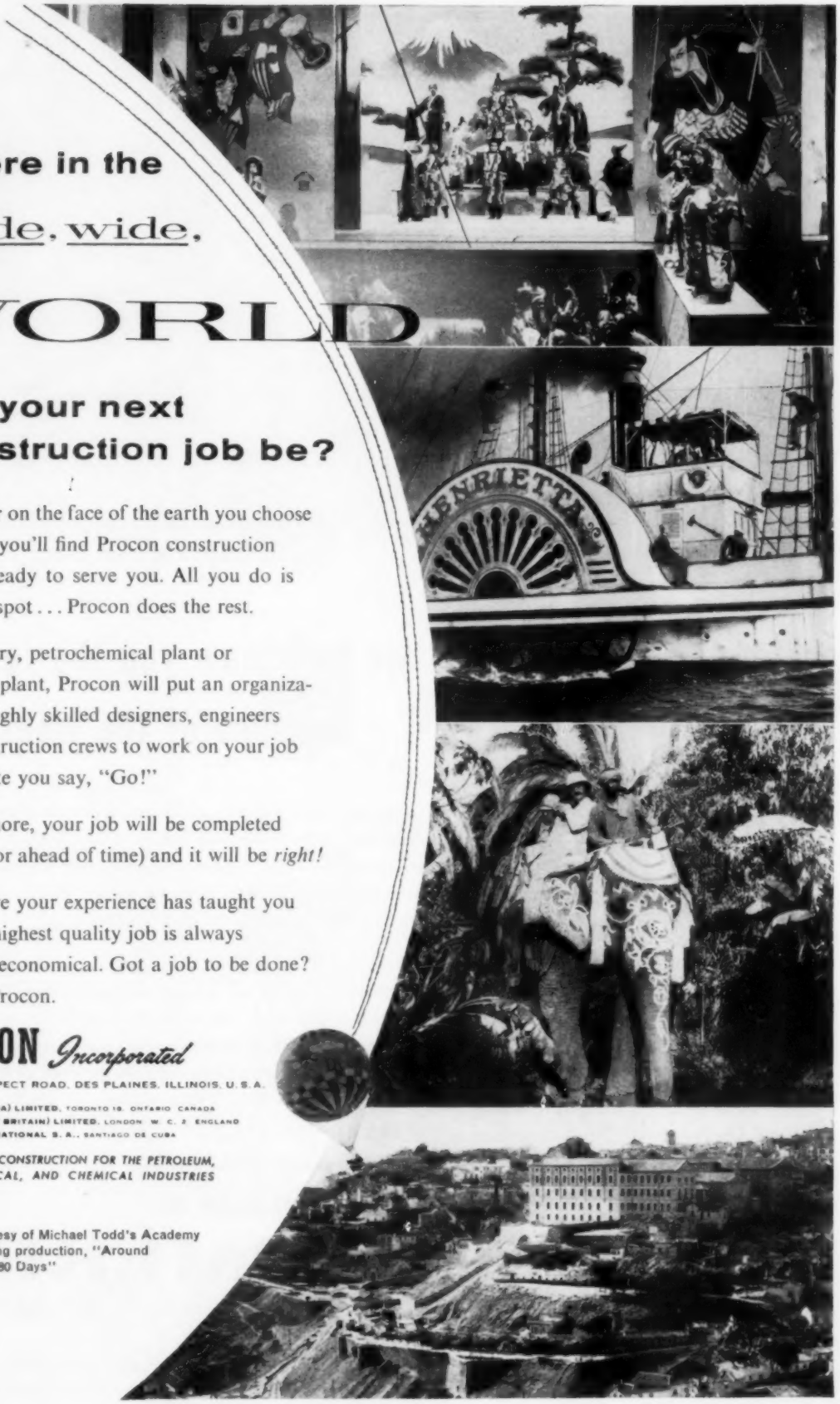
YOUR INDUSTRIAL SUPPLY DISTRIBUTOR is as close as your telephone. Let him help you select the right Hancock "Flocontrol" Valves for your needs. You can depend on him for fast delivery from local stocks.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

HANCOCK VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** Watertown 72, Massachusetts

MAKERS OF 'ASHCROFT' GAUGES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, Calif.* "SHAW-BOX" and 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*



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wide, wide,

WORLD

will your next construction job be?

Wherever on the face of the earth you choose to build, you'll find Procon construction experts ready to serve you. All you do is pick the spot . . . Procon does the rest.

Oil refinery, petrochemical plant or chemical plant, Procon will put an organization of highly skilled designers, engineers and construction crews to work on your job the minute you say, "Go!"

What's more, your job will be completed on time (or ahead of time) and it will be *right!*

We're sure your experience has taught you that the highest quality job is always the most economical. Got a job to be done? Call on Procon.

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WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

Photos courtesy of Michael Todd's Academy Award winning production, "Around the World in 80 Days"

we can show you the forest because of the trees

Many times oil men feel they are in a poor position financially simply because they can't see the entire picture of their operations. Caught in the complexities of their day-to-day activities, they are unable to survey their properties in a realistic, objective manner. And as a result, many times they end up working for their creditors.

Increased operating costs spell falling profits. And that means trouble. While there is no short cut way out of this problem, The Commerce working with your legal and tax counsel can many times show you how to increase profit by reducing costs. Tighter managerial control, an analysis of costs, and recommendations for changes have increased the profit of other oil men. If your problems are similar, come to the bank that actually does know the oil business and that can help you.

E. O. Buck, vice president, Oil Loan Department

Member Federal Deposit Insurance Corporation

THE NATIONAL BANK OF

COMMERCE

Gulf Building, Houston, Texas **OF HOUSTON**

Facilities of The National Bank of Commerce Oil Loan Department are available in Wyoming, Nebraska, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

They Say—

Long job, well done

Dear Sir:

I was certainly gratified to see the generous treatment your publication devoted in the August 12 Journal to the meeting of the 18 cooperating oil-industry associations in Dallas on August 5, 1957.

Further, I was greatly surprised to note that a picture of Mr. W. M. Vaughey, chairman of I.P.A.A's executive committee, and me adorned the cover of the same issue. Speaking for myself, this distinction was far more than I deserved. I do feel that sometimes in the enthusiasm of extinguishing the fire, the man on the pumps is obscured by the fireman with the nozzle!

As you know, an equitable solution to the import problem was the basic tenet upon which the Independent Petroleum Association was founded in 1929. Without the constant and steadfast effort of all those who have worked on this problem since that time, the present awareness in Government of the problem would have been unattainable.

Your kind consideration of the historic position of the independent segment of the American oil industry as to a necessity for imports supplementing and not supplanting domestic production has long been known in the industry. Quite often your articles and editorials have given encouragement to those of us who at times tend to become discouraged.

I should like, also, to take the liberty of expressing the appreciation of the 17 other cooperating associations for your considered attention during the Dallas meeting.

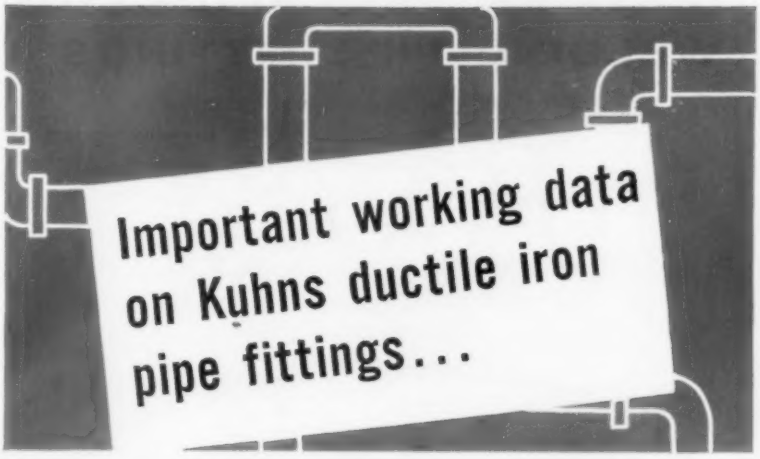
Robert L. Wood,
President,
Independent Petroleum
Association of America.

Badger has Esso contract

Dear Sir:

In The Oil and Gas Journal of July 29, you give a midyear report on refinery construction in the United States and Canada. We note on page 188 under Esso Standard Oil Co. that you have reported Esso's new Powerformer and Hydrofining Unit at Everett, Mass., and you state, "Blaw-Knox has contract for Powerformer."

. . . This is not a correct statement. Badger Manufacturing Co. has the contract for the Powerformer being con-



"K" Pipe Lock Couplings

Listed for 800 psi working pressure by Underwriters' Laboratories, Inc., "K" couplings have a safety factor of five times the UL listing for 2½" through 6" and four times the UL listing for 8". Sizes: 2½" through 8". Look for the "800 D" on each.

"K" Flanges and Flanged Fittings

Elbows, base elbows, 45° elbows, side outlet elbows, tees, side outlet tees, and reducers in straight and reducing sizes. Pressure rating, 500 psi by Underwriters' Laboratories, Inc. Flat faced flanges shipped as standard. Extra heavy flange dimensions and raised faces available on request. Look for the "DI 500" on each.

"K" Screwed Fittings

Pressure ratings listed by Underwriters' Laboratories, Inc.

STEAM AND OIL AT 550°F
¼" to 3".....300 lbs.
LIQUID AND GAS AT 150°F
¼" to 1".....2000 lbs.
1¼" to 2".....1500 lbs.
2½" to 3".....1000 lbs.

Note: These fittings are excellent for liquefied petroleum gas systems. Look for the "D 300" on each.

WHEN TO USE: Where structural strength and thermal shock resistance are specified. When high pressure sealing is vital to reduce hazards such as fire and explosion. To prevent leakage due to wide temperature changes, vibration and misalignment. Where rust and corrosion are problems. When fittings are to be reused. As Kuhns supplies cast, malleable and ductile iron fittings, these are impartial engineering recommendations.

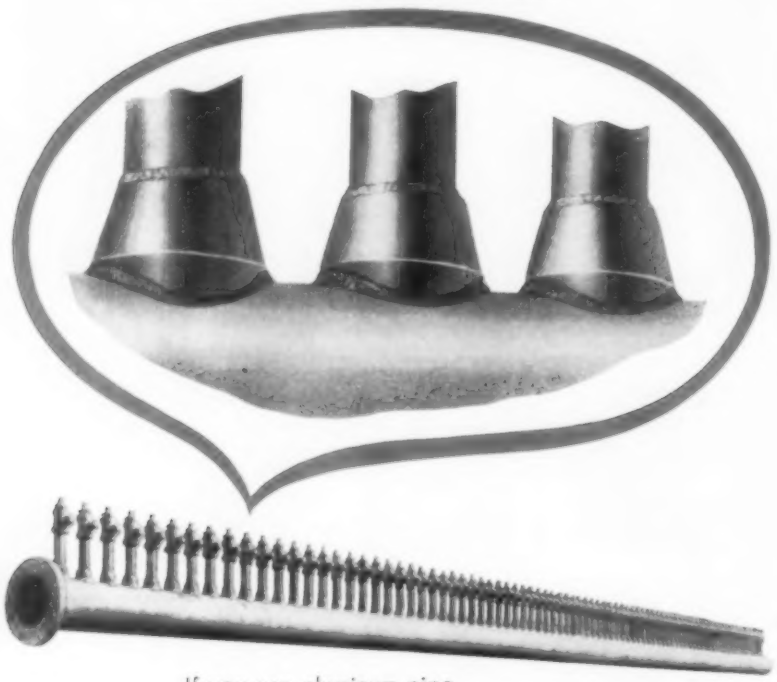
Send for our catalog on ductile iron pipe fittings—the newest development in the industry. Available at better wholesalers.

THE KUHNS BROTHERS CO.
1800 McCALL STREET, DAYTON, OHIO
1887 • 70 Years of Continuous Progress • 1957

DROP FORGED ALUMINUM WELDING PIPE FITTINGS

5200 SOCKOLETS were used on this pipe fabrication contract—one of the seventy headers is shown below. Note uniformity, strength and ruggedness of this drop forged fitting at the critical branch connection.

LOW COST—the pipe fabricator who was awarded this job was the one whose bid was based on using Bonney Sockolets.



If you use aluminum pipe,
SPECIFY and USE

BONNEY ALUMINUM

ALUMINUM
CARBON STEEL
STAINLESS
ALLOY
for all services

WELDOLETS
SOCKOLETS
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Sold through leading warehousing distributors

BONNEY

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BONNEY FORGE & TOOL WORKS
Dept. H
ALLENTOWN, PENNSYLVANIA

structed for Esso Standard Oil Co. at Everett.

W. C. Rousseau
Vice President
Badger Manufacturing Co.
Cambridge, Mass.

Proration in Texas

"Crude-oil storage available to Gulf on August 1, 1957, was within 1,250,000 bbl. of being filled . . .

"In July, when submitting Gulf's August nominations, we had reason to believe we could dispose of receipts resulting from a 13-day schedule; however, anticipated sales did not materialize. Consequently, we now have an over-supply of approximately 35,000 bbl. daily for which we have no storage. All efforts to find a purchaser for this over-supply have failed.

"We understand that Gulf is not in a unique position . . . Unless the commission sees fit, in the light of over-all stock conditions, to revise its order for August on the basis of a 10-producing-day pattern for the last 15 days of August and adopt a 10-day order for September, Gulf will, of necessity, have to prorate unless it can find purchasers for 35,000 bbl. daily.

"With a 10-day pattern for the remainder of August and 10 days for September in Texas, it is thought that the necessity for continuation of this low allowable will have passed."

Gulf Oil Corp. in a statement to the Texas Railroad Commission at the September allowable hearing.

Proration in Oklahoma

"All Oklahoma producers are disturbed that we are again faced with purchaser proration in our state. It is impossible to avoid this at times, with labor strikes, disasters, and world-wide emergencies that periodically affect our market.

"The (Oklahoma Corporation) commission has done an outstanding job in their efforts to determine the true market demand and, for the most part, the purchasers and producers are to be commended for their cooperation. However, there have been actions taken by some companies that in our mind, threaten the jurisdiction and regulatory powers of the commission.

"The failure of a company to abide by the rules and special orders of the commission (set up and issued under the authority granted them) can only serve to jeopardize our whole system of conservation in Oklahoma.

"In every instance, where proper application has been made by purchasers to prorate, the commission has been diligent in its efforts to give relief with the facts squarely before them. The

Now!

Davison
antioxidants

Davison, long the leading catalyst supplier, now offers two antioxidants to the refining industry . . . Dav-Ad 101 and Dav-Ad 102.

You'll find these antioxidants offer more advantages than other types for use in a long list of products: motor and aviation gasoline; turbine, transformer and lubricating oils; jet fuels; synthetic lubricants; various plastics; rubber; asphalt tile; waxes; industrial fats and oils.

Dav-Ad 101 is available in 100-pound fiber drums ... Dav-Ad 102 in 55-gallon steel drums containing 400 pounds net, or in tank car lots. Stocks are located at Baltimore, Md., Lake Charles, La. and Cincinnati, Ohio for your convenience.

Write today for samples, specifications and prices.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

Baltimore 3, Maryland

SALES OFFICES: Chicago, Ill.; Houston, Tex.; New York, N. Y.; Baltimore, Md.; San Francisco, Calif.; Tulsa, Okla.
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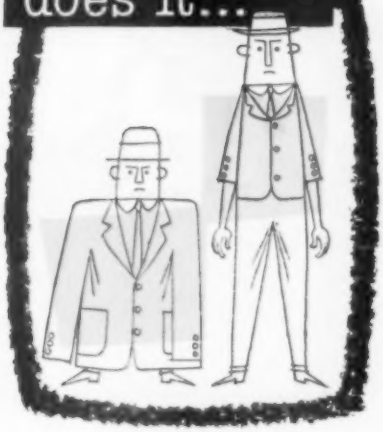
no one coat does it...



one source does

Valdura offers maintenance paints made from specific resins for every condition

EPON

VAL-CHEM. Versatile, chemical resistant metal primer for use under any finish coat. VALPON ENAMEL. Prevents damage by oils, solvents, alkalies and other chemicals on wood, metal or masonry.

PARLON

PARAVAL ENAMEL. Not affected by acids, alkalies and other chemicals. Used on wood, metal, concrete or masonry. RUBBER BASE ENAMEL. Combines excellent exterior durability with high chemical resistance.

BAKELITE

SUPER SERVICE ENAMEL. Resists chemical, moisture and abrasive conditions on metal wood or masonry. ASPHALT ALUMINUM PAINT. 98% waterproof metal coat prevents rust, rot, corrosion. Highest reflectivity.

COAL TAR

SEWAGE DISPOSAL BLACKS. Used for protecting concrete and metal surfaces from water, etc., found in sewage plants, reclamation projects, refrigeration systems, metal and concrete pipe, marine exposures.

URETHANE

URAVAL. The very latest type of coating that combines the ultimate in resistance to chemicals, solvents, marring and abrasion. Uraval will stand up where all other types of coating have failed.

ALKYD

M & F ENAMEL (General Maintenance), VALKOTE (Implement Enamel), DARYWHITE. Products that utilize the outstanding durability of alkyd resins. All these coatings are hard, tough, quick drying and color retentive.

Valdura maintenance paints are stocked by leading industrial distributors everywhere!

VALDURA PAINTS THAT ENDURE

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HEAVY DUTY
PAINT DIVISION
AMERICAN-MARIETTA CO.
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687 Wellington St., Ottawa, Canada

action of Gulf Oil Corp. in ignoring the orders of the commission is without precedent, a violation of the laws and regulatory bodies of our state and serves only to undermine our conservation program.

"Your actions in the past concerning this matter are commendable. The producers and purchasers must know where the authority lies. Gulf Oil Corp.'s actions are in contempt of the commission's orders and must be dealt with accordingly. We urge that immediately, upon official determination that these malpractices are taking place, the sternest action be taken.

"It is our intention, as in the past, to support you 100 per cent in this endeavor."

Paul R. Schultz, president, Oklahoma Independent Petroleum Association in a letter to Ray C. Jones, chairman of the Oklahoma Corporation Commission.

To producers, a warning

"Since announcement of the imports plan, there have been some indications that domestic production is expected to advance. But it would be unfortunate indeed if domestic output should be increased to fill a void created by an imports reduction, while disregarding other economic factors. To do so would represent a canceling out of much of the objective of an imports reduction.

"On numerous occasions during the postwar period the industry has been rendered unhealthy by seasonal excesses of new supply. Too much supply, regardless of the source, inevitably leads to price deterioration.

"In some industries lower prices stimulate greater consumption which offsets higher costs. But this is not true of the petroleum industry. The demand for oil is inelastic . . . Oversupply, therefore, can only lead to financial loss.

"Refiners, in a price and cost squeeze, are forced to seek cheaper crude oil. And pressure on the price structure results.

"The volume of oil represented by the proposed imports reduction, when parceled out among the thousands of domestic producers, is not an imposing figure. Certainly it alone can hardly provide much additional incentive to explore. There must exist at the same time an adequate and stable price structure. This cannot be if oversupply persists. And oversupply will persist if an imports reduction is regarded as a green light to raise domestic output."

John G. Winger, petroleum economist, Chase Manhattan Bank, in his monthly review of the petroleum situation.

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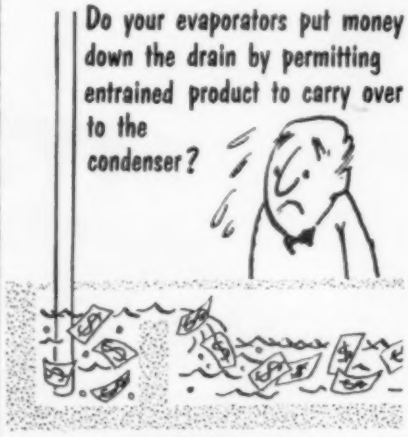

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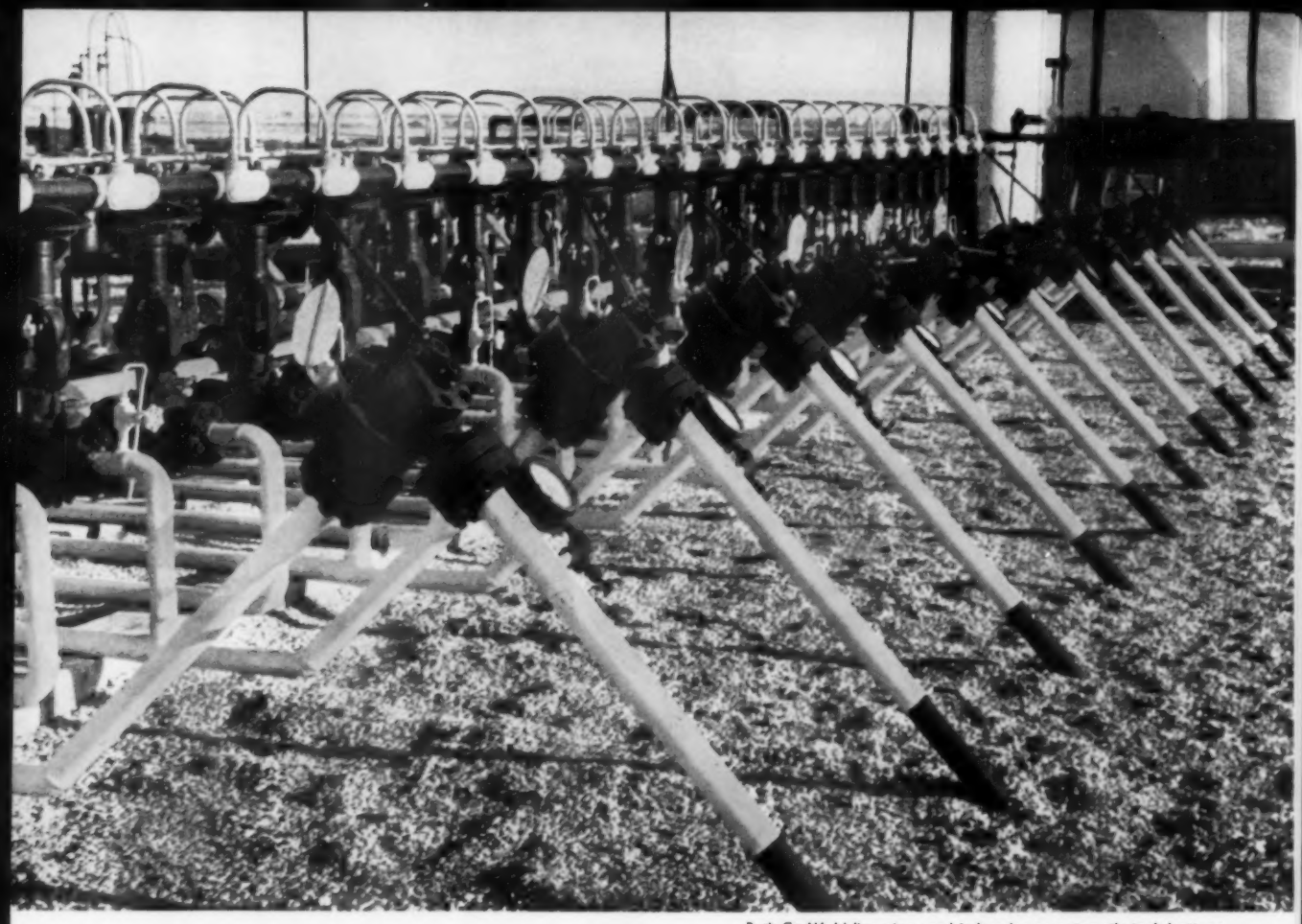

Beth-Co-Weld line pipe used in header on automatic tank battery.

Beth-Co-Weld line pipe serves in so many ways

There are so many uses for Beth-Co-Weld line pipe around the lease or rig—so many places, such as gathering and distribution systems, service lines and maintenance work, where it can be used with complete confidence.

And Beth-Co-Weld is such good, sound pipe. It's made from a good grade of steel. In fact, Beth-Co-Weld was one of the first fully accepted types of continuous-weld line pipe made for the oil industry. What's more, Beth-Co-Weld saves you time, for it's readily available, either black or galvanized, from your johnny-on-the-spot Bethlehem Supply store.

ANSWERS TO QUESTIONS WE'RE OFTEN ASKED

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It comes coated. Also uncoated for field wrapping, or mill-wrapped.

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Lengths: Single mill lengths. Also double mill lengths up to 50 ft in sizes 1½ in. through 4½ in. OD.

Types of Ends: Threaded and coupled; plain end beveled for welding; plain end square-cut, grooved for ring-joint coupling.

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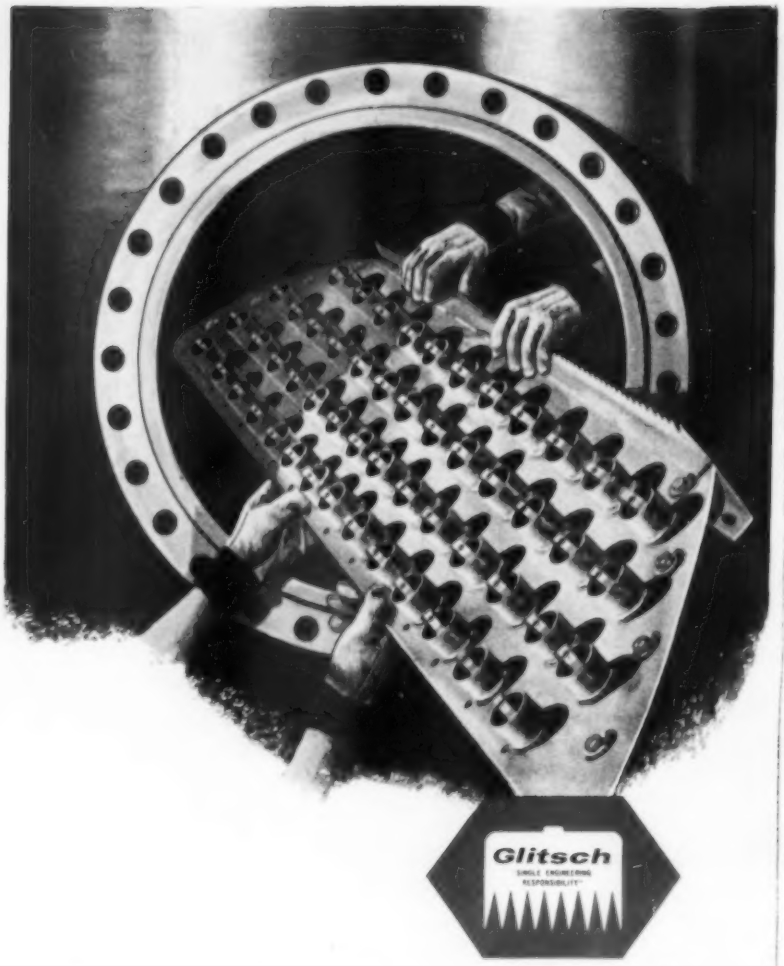

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CALENDAR

SEPTEMBER

3-5 Pacific Coast Gas Association convention, Fairmont and Mark Hopkins Hotels, San Francisco.

5-7 New Mexico Geological Society, eighth annual field conference, southwestern Colorado.

8-13 American Chemical Society, 132nd national meeting, New York City.

9-10 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

9-11 American Institute of Electrical Engineers, conference of the petroleum industry committee, Sheraton Hotel, Philadelphia.

11-13 National Petroleum Association, fifty-fifth annual meeting, Traymore Hotel, Atlantic City, N. J.

12-14 Wyoming Geological Association, twelfth annual field conference, Southwest Wind River basin, Noble Hotel, Lander, Wyo.

12-14 Ardmore, Okla., Geological Society, Criner Hills field conference, Lake Murray Lodge, Ardmore, Okla.

19-21 Rocky Mountain Oil Show, fairgrounds, Casper, Wyo.

20 Southern Gas Association, dispatchers' round-table conference, Baker Hotel, Dallas.

20 Southern Gas Association, compressor station round-table conference, Baker Hotel, Dallas.

22-25 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Mayo Hotel, Tulsa.

23-24 University of Oklahoma, School of Petroleum Engineering conference on fluid flow through porous media.

23-25 American Society of Mechanical Engineers, fall meeting, Statler Hotel, Hartford, Conn.

25 Natural Gasoline Association of America, regional meeting, Northern Hotel, Billings, Mont.

26-27 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

26-27 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, Roosevelt Hotel, New Orleans.

30-Oct. 2 American Oil Chemists' Society, 1957 fall meeting, Netherland Plaza Hotel, Cincinnati.

OCTOBER

1-2 Texas Mid-Continent Oil and Gas Association, thirty-eighth annual meeting, Texas Hotel, Fort Worth.

1-4 National Association of Corrosion Engineers, north-central region, Sherman Hotel, Chicago.

1-4 National Association of Corrosion Engineers, south-central region, municipal auditorium, Oklahoma City.

2-4 Golden Trend Oil Show, Pauls Valley, Okla.

6-9 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fall meeting, Adolphus, Baker, and Statler Hilton Hotels, Dallas.

7-9 National Electronics Conference, thirteenth annual meeting, Hotel Sherman, Chicago.

7-9 American Gas Association, annual convention, Kiel Auditorium, St. Louis.

7-11 American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago.

10-11 California Natural Gasoline Association, thirty-second annual fall meet-

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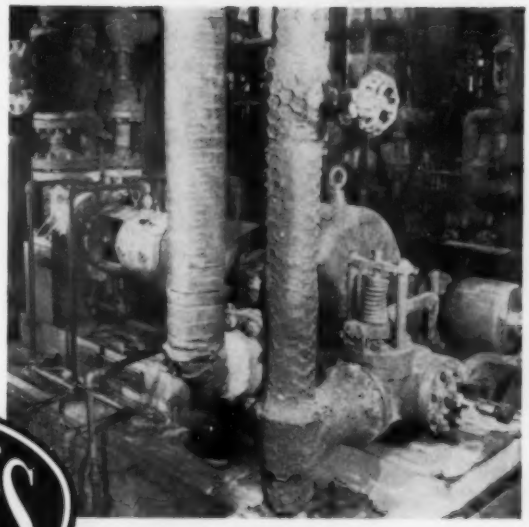

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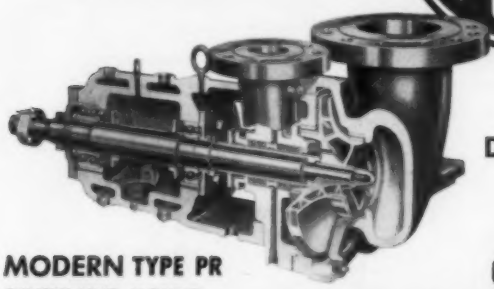

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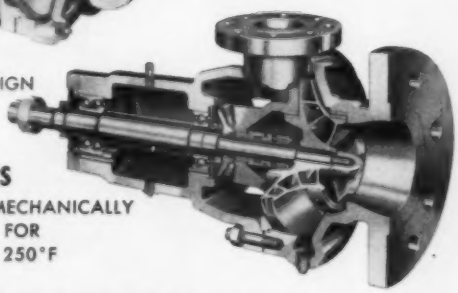

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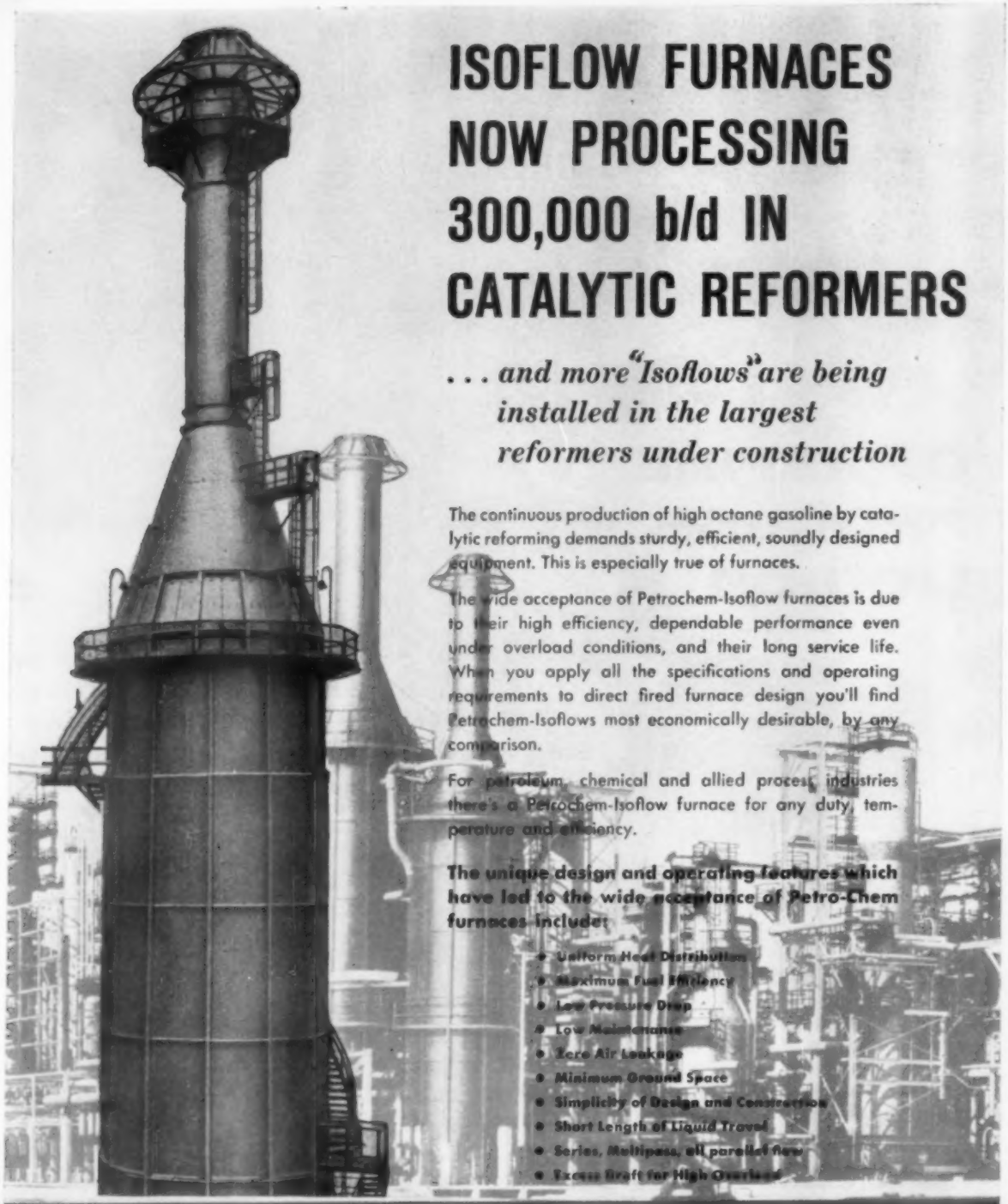

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ing, Huntington-Sheraton Hotel, Pasadena.

10-12 American Society of Mechanical Engineers, American Institute of Mining, Metallurgical & Petroleum Engineers, fuels conference, Chateau Frontenac, Quebec.

10-13 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

13-15 American Association of Oilwell Drilling Contractors, seventeenth annual meeting, Mayo Hotel, Tulsa.

13-19 OIL PROGRESS WEEK.

15-16 Gas Measurement Institute, sponsored by the University of Kansas, American Legion Hall, Liberal, Kans.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Southern California petroleum section, fall meeting, Biltmore Hotel, Los Angeles.

17-19 Four Corners Geological Society, second field conference, Gallup, N. M.

18 American Institute of Chemical Engineers, South Texas section, twelfth annual technical meeting, Moody Convention Center, Galveston, Tex.

20-22 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Peabody, Memphis.

23-25 National Association of Corrosion Engineers, western region, seventh annual conference, U. S. Grant Hotel, San Diego, Calif.

23-25 National Association of Corrosion Engineers, seventh biennial Permian basin corrosion tour, Lincoln Hotel, Odessa, Tex.

24-25 Rocky Mountain Oil and Gas Association, midyear meeting, Northern Hotel, Billings, Mont.

24-25 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

25 Natural Gasoline Association of America, southern regional meeting, Washington-Youree and Captain Shreve Hotels, Shreveport.

27-29 Independent Petroleum Association of America, annual membership meeting, Statler Hilton Hotel, Dallas.

31-Nov. 1 American Association of Petroleum Geologists, Mid-Continent regional meeting, Education Building, Fairgrounds, Tulsa.

NOVEMBER

3-8 Society for Nondestructive Testing, second international conference, Hotel Morrison, Chicago.

6-8 Gulf Coast Association of Geological Societies, seventh annual convention, Roosevelt Hotel, New Orleans.

6-8 Society of Automotive Engineers, national fuels and lubricants meeting, Hotel Statler, Cleveland.

11-14 Society of Exploration Geophysicists, twenty-seventh annual meeting, Statler-Hilton Hotel, Dallas.

11-14 American Petroleum Institute, thirty seventh annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

12-14 National Association of Corrosion Engineers, northwest region fall meeting, Penn-Sheraton Hotel, Pittsburgh.

22 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Tulsa.

1-6 American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York.

BARCO Flexible BALL JOINTS

"Moves in Any Direction!"

UNLOADING ACID—This 2" flexible unloading line for acid tank cars is made with the aid of two Barco Ball Joints in stainless steel with No. 11CT gaskets.

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Barco's Bar-Ductile metal ball offers good resistance to chemical action and corrosion. Where additional protection is desired, these parts can be supplied in stainless steel or virtually any alloy specified.

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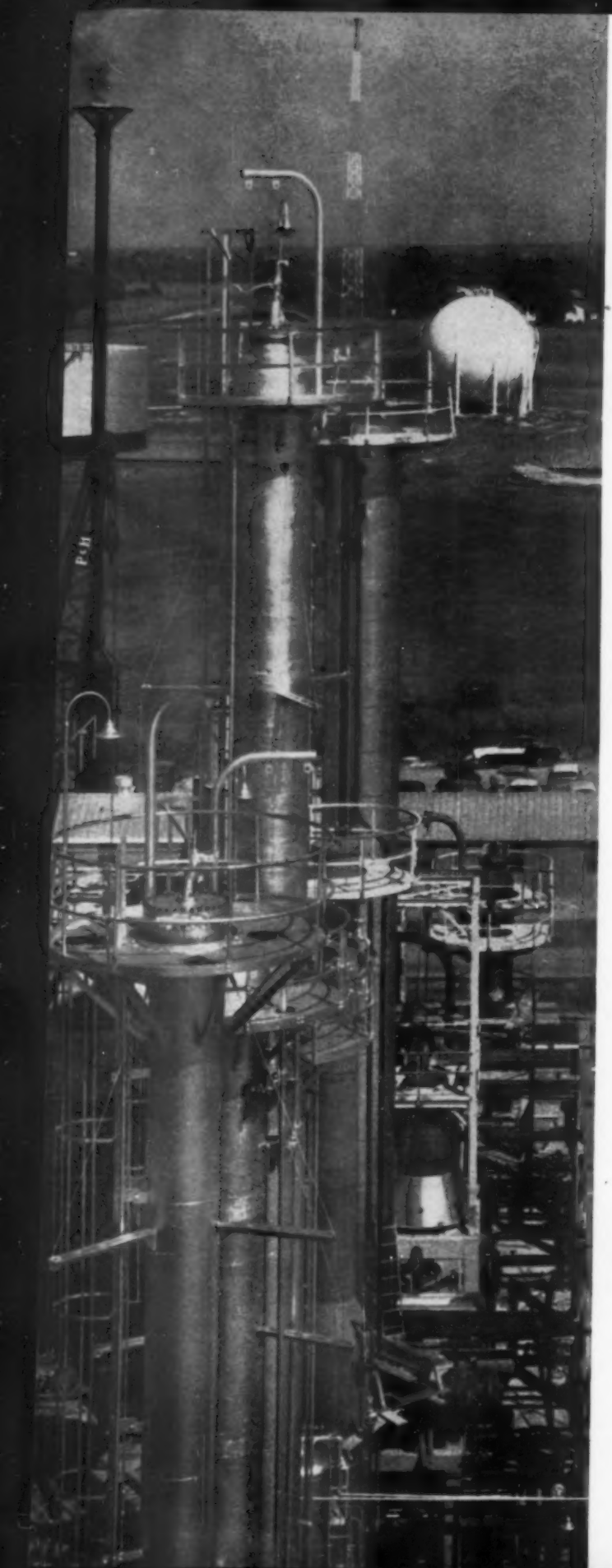

This SWECO-built refinery addition helped an Indiana plant pull from behind to a front position in the race to upgrade gasoline.

High Octane Package Handled with Care

Like many refineries, the Mt. Vernon plant of the Indiana Farm Bureau Association was caught with its rating down when the latest high octane race started. That was before SWECO wrapped up a $1,500,000 refinery package that included a 3,000 BPSD platformer, a 2,100 BPSD unifiner, and a new steam generating plant with an hourly capacity of 120,000 lb. of high-pressure steam.

Off and running

The platformer-unifiner team went on stream in November, 1956, and has been in continuous operation ever since. This combination unit, built under license from Universal Oil Products Company, makes Mt. Vernon a front runner in today's race to upgrade gasoline.

In planning the steam generating plant, SWECO engineers decided to save time by specifying the equipment and letting bids for fabrication. But outsiders couldn't meet the cost estimates or contract, so SWECO built the pressure vessels in its Los Angeles plant. They were delivered three days ahead of schedule.

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Heavy spring washouts and a tight budget were just some of the problems the SWECO engineering and construction crews took in stride. Designing and building moderate-size refinery installations is their specialty.

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

Waiting in the Wilderness

THE HOTTEST oil and gas area in the country today is the region stretching from the so-called Four Corners up the western slope of the Rockies in Colorado and Utah.

Our favorite oil publication has carried many articles on the current rapid development in this region (and will have another big one next week). All the articles stress the difficulties of getting around and operating in this remote desert region with its rough terrain and lack of roads and water.

Oil men working there probably agree that a Mormon writer a century ago had some justification for his pessimism when he described the region as "one vast contiguity of waste and measurably valueless, excepting for nomadic purposes, hunting grounds for Indians, and to hold the world together."

The average man in the street, reading about the big oil and gas fields out there in the wide-open spaces "where the scenery is attractive and the air is radioactive" probably thinks that this is a sure and easy way to get rich quick.

Too bad Mr. Averageman doesn't know the real facts. The story of Piceance Creek, for instance. Piceance is an Indian word with a French spelling (pronounced Pee-awnce) meaning "tall grass." It's in a particularly rugged and isolated area in Colorado near the Utah line.

This year the big Piceance gas field started selling gas—after waiting 28 years for a customer.

The field was discovered by Socony Mobil in 1928. The geologists thought there might be oil there and that the oil could be got to a market even though the field was 50 miles from the nearest town and there were no roads. But gas was discovered instead, and there were no customers for gas for hundreds of miles in any direction.

A lot of things have happened in the world since 1928. In that year Herbert Hoover was elected President, and Charles Lindbergh had just shown that an airplane could fly the Atlantic. But nothing much happened at Piceance Creek. Now and then Socony drilled a few more wells and found lots more gas but no oil. It capped the wells, kept one permanent employe on the pay roll as caretaker all that time, and just sat on its investment waiting for something to develop.

Finally, during the last few years, the business and financial world woke up to the value of natural gas. People started going after it, even in remote places. The Pacific Northwest Pipeline was projected through the region, and routed within 50 miles of Piceance Creek. It would pay to run a spur that distance to pick up such a sizable volume of gas.

At last the long-range gamble of Piceance Creek is paying off. At least it's selling some gas. But we wonder how 28 years of idle investment will be calculated by those who insist that the field price of gas should be based on actual cost of discovery.

"Oil is where you find it," but the chances of getting rich quick in finding oil and gas depend not only on where you find it but when.

Wassailing in Washington

SO WASHINGTON is now an oil-producing state. At least our Exploration Editor appears to be about ready to concede that maybe it might be. (Read pages 215 and 216 and figure it out for yourself.)

The folks around Grays Harbor have no doubt about it. In fact, they were so sure of it in advance that they planned a victory celebration for the initial production test. We received two formal invitations "requesting the honor of your presence" at cocktail parties thrown for the occasion.

Now that's a custom that ought to spread throughout the oil patch. Of course we might not be able to attend all the well-completion parties, but with more than 1,000 wells being completed in this country every week . . . ah, it's too wonderful to even think about.

—*Henry D. Ralph.*

"All set"

Each Baker Centralizer Spring is carefully formed with a bowed height that is greater than it should be for its length . . . in accordance with Baker's original Optimum Centralizer Spring Design. The spring is then *pre-set* by being completely flattened in a press and allowed to return to the exact bowed height specified by the Optimum Spring Design. Since this specified bowed height of the springs will not thereafter be materially lessened due to permanent set . . . even when the centralizer passes through tight spots or dog-legs in the hole — the *net effective reach* to center the casing is present when cementing is started. You are *all set* for best results.

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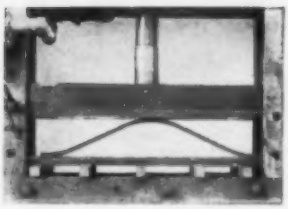
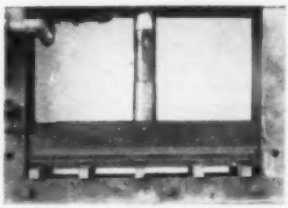
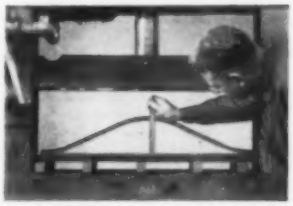


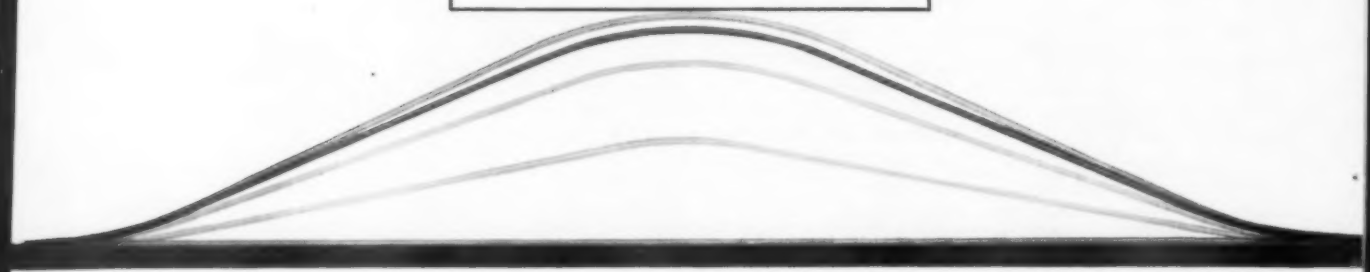
Spring in position in hydraulic press for flattening test.

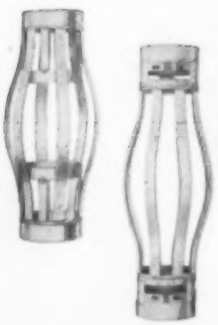


The tightest hole could not flatten any spring more than this.



The specified bowed height (reach) must be present after the slight permanent set.





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Our imports plan won't injure foreign nations

FOREIGN nations exporting oil to the United States need not be unduly alarmed over the new United States policy of placing an annual ceiling on the volume of petroleum imports.

The new plan is not a blow to foreign trade, not a retaliation against anything, not a discrimination against any country. It is simply a modest extension beyond our shores of the principle of prorating supply to the demand of the current market.

If foreign nations will accept it in this light, and will adapt their oil production to it, they may find that the plan will actually bring them benefits in economic stability and more dependable long-range planning.

THE PRORATION PRINCIPLE has worked in a rough but reasonably satisfactory way in the chief oil-producing states of this country and several provinces of Canada. It is neither new nor drastic.

It is based on the fact that nobody profits very long when more oil is crowded onto a given market than that market can consume. Since unneeded crude oil can best be stored in its natural reservoirs, production is held down to the estimated level of market demand.

The chief factor in making this estimate is periodic "nominations" by the larger purchasers. There is no allocation of quotas among the several states, and purchasers buy from whatever area is most attractive to them.

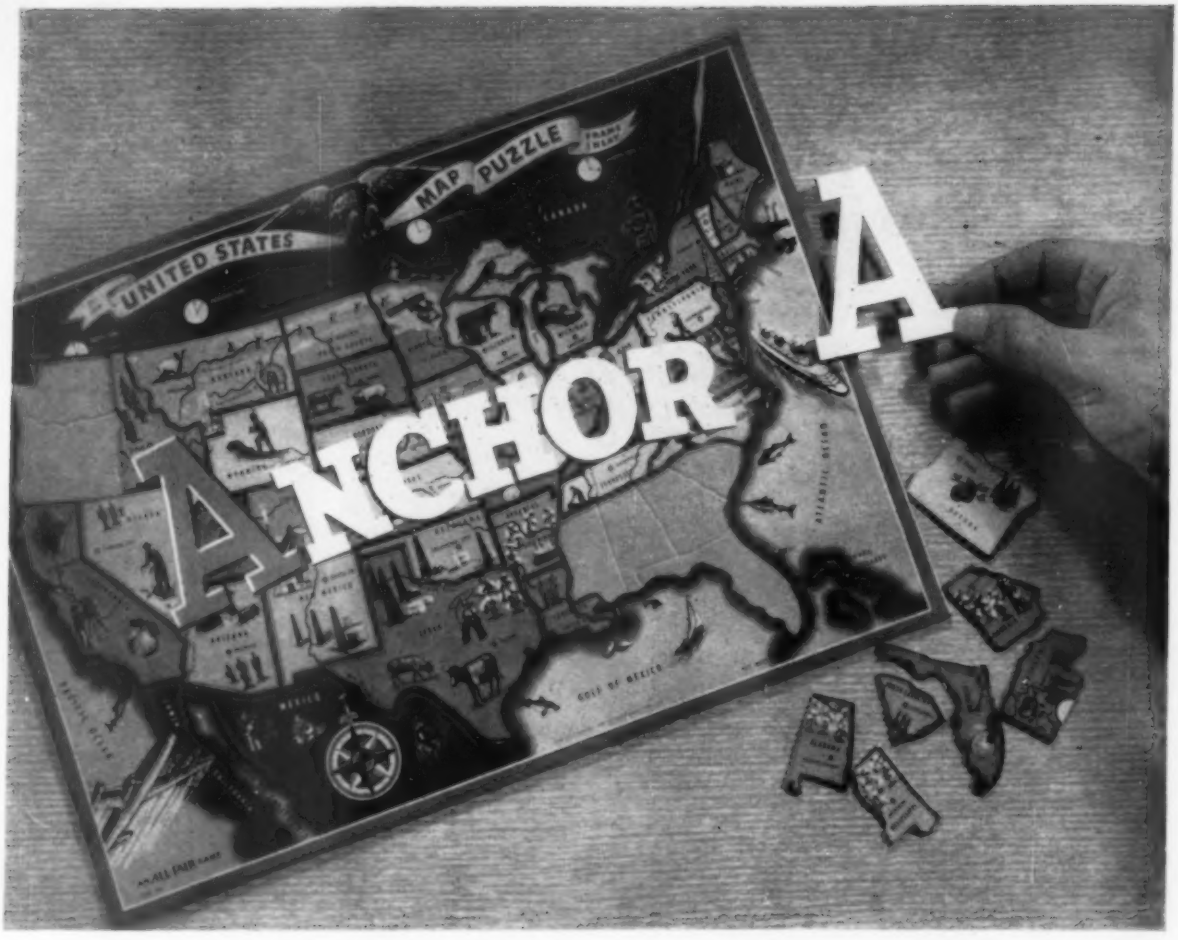
Proration to market demand has brought stability to the domestic producing industry. It nearly has eliminated violent fluctuations in crude-oil prices and feast-and-famine conditions in supply. It permits producers to plan their future operations and has greatly facilitated their financing because they have at least an approximate idea of how much oil they will be able to sell.

NOW THE UNITED STATES is, in effect, "nominating" to purchase 1,031,000 bbls. per day of foreign crude during the current 12 months. In another year the conditions may indicate higher allowable imports.

This is notice to countries eager to expand their production that the United States market, great as it is, is not unlimited. But it is a growing market, and, at last, the share of that market available to foreign oil is a predictable one.

Foreign countries must still compete for this market. But they know its size, and each should be able to estimate its probable share of it. Moreover, they can be reasonably confident that this market will have a stable and reasonable price.

Under the new U. S. policy, therefore, exporting nations can do a better job of planning their operations and stabilizing their economy. If they adjust to a known demand, as do U. S. producers, these benefits could offset their current reduction in sales to this country.



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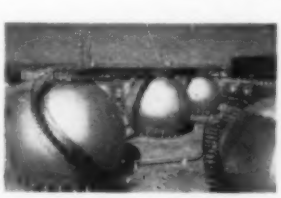
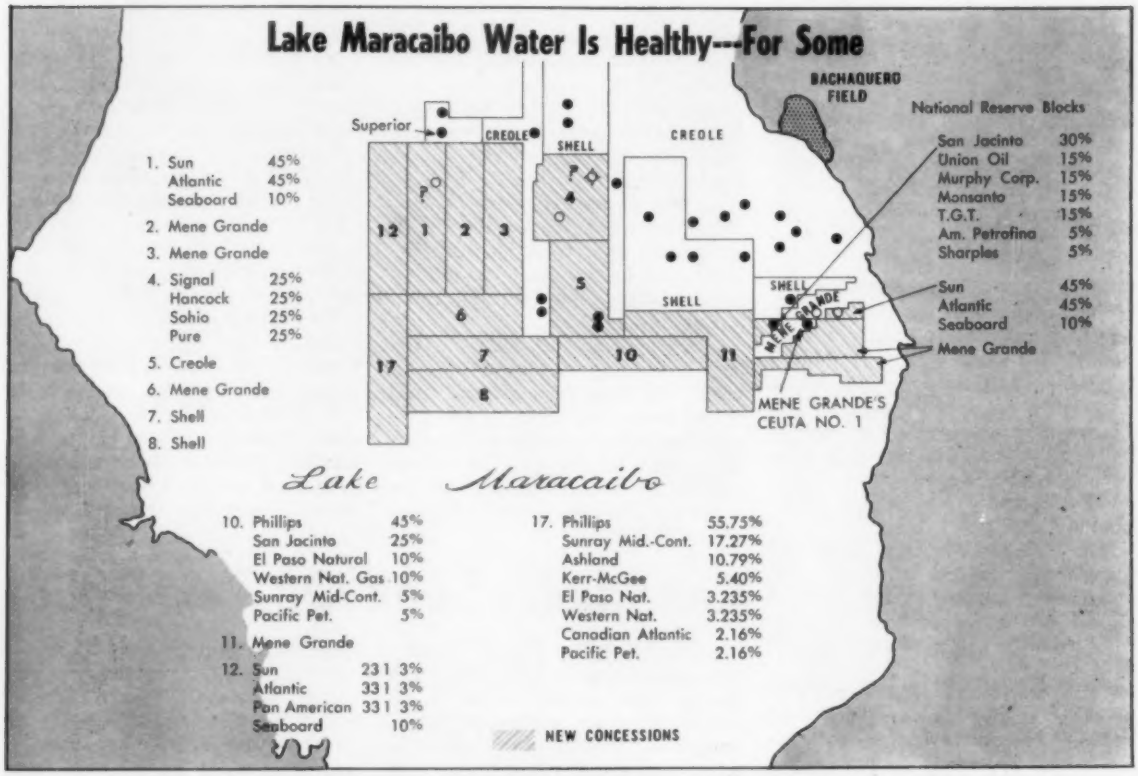




Lake Newcomers Take Drilling Plunge

● How are American oil men doing with their $400-million bet in Venezuela? Some may have hit it rich. It's too early to tell about others. But one thing stands out: New strikes so far all have made oldtimers look good.

Paul Swain
International Editor

PROSPECTS are bright for heavy new production in Lake Maracaibo.

But one fact stands out these days: A lot of drilling still must be done before everyone who paid a piece of the more than $400 million for new lake acreage in Venezuela can start counting chips.

Much of the Maracaibo acreage went for fancy prices both in the 1956 sale and the one held this year. It was pretty highly regarded as semi-proved. Because of this, the leases drew some premium bonuses.

At this point it appears that those bonuses may have been well spent in some cases. But in others the question of payout hasn't yet been answered.

Busy freshmen . . . The newcomers are making the most noise so far and doing the most work.

Some of them are coming up with oil, too.

The oldtimers in Venezuela, especially in Lake Maracaibo, haven't said a word. They've also been doing a little digging. But this is the uncanny feature of lake drilling so far: Almost every time a newcomer reports a good well, it is in a location that makes one of the oldtimers look very comfortable—either on newly acquired acreage or on some they've held for years.

Before all the lake blocks look good, however, the drilling trend will have to switch. Companies which hold the newest tracts in the southwest corner of the new acreage must do some drilling. So far the activity has been pretty well confined to the north, the central portion, and the east side of the lake where small tracts of national reserve acreage are involved.

What's happening . . . Here's what new drilling in the lake has shown so far:

. . . On the northwest edge of the new lake acreage, Superior Oil Co.

has drilled two flush producing wells (OGJ, Aug. 26, p. 90).

The two Superior wells, one testing more than 3,300 bbl. daily and the other more than 7,600 bbl. daily, apparently vindicate the company's judgment in paying a record bonus of $2,831 an acre for the 7,774-acre national reserve block.

In addition, the two wells certainly make the old acreage to the north and the east look promising. This is lake bottom which Creole Petroleum Co. has had for years.

To the south of Superior's tract are large blocks of new lake acreage held by an oldtimer in Venezuela, Mene Grande Oil Co., and two new groups headed by Venezuelan Sun Oil Co. and Venezuelan Atlantic Refining Co.

Meneg has not yet tested its big tract of more than 49,000 acres for which it paid almost $56 million in bonuses last year.

The Sun-Atlantic group has drilled one well about 6 miles south of the nearest Superior well. The test is called a tight hole and no details have been revealed. Reports from Venezuela are that it has been a disappointing well.

The Eocene production found by Superior just to the north of these two large blocks of acreage point to similar production in both, at least in the northernmost sections of the two.

... **In the center** of the new lake acreage, a four-company group of independents, all newcomers to Venezuela, has apparently hit pay on the second well drilled in the big Lot 4.

The four, Signal Exploration Co., Hancock Oil Co., Standard Oil Co. of Ohio, and Pure Oil Co., paid almost $33,700,000 for the 27,600-acre block.

The first well drilled by the Signal group found the expected Eocene pays thin and encountered water troubles in the formation. The second well, about 4 miles to the southwest, has drilled into more than 100 ft. of pay at about 9,800 ft. and is deepening the test to the Cretaceous.

If Signal succeeds in making a producing well out of either of the two it has drilled so far, Creole won't be unhappy. Creole, the Venezuelan giant, has acreage on four sides of the Signal group's block.

In fact, Creole has pretty well proved the new lake block just to the south of the one held by the Signal group. Creole paid nearly $25 million for this 25,441-acre tract last year.

Since that time the company has made a new field discovery at C1-1 on the narrow finger of old acreage which borders the block to the west. A second well, C1-2, has been drilled offsetting the discovery.

Reports from Venezuela last week indicate that Creole has also drilled two tests, both of them productive, in the southeast corner of the new block.

... **To the northeast** toward Bachaquero field, both Creole and Cia. Shell de Venezuela have done extensive wildcat drilling on old lake acreage which both companies have held for years. It is apparent that this area of the lake will yield a field equal to Bachaquero, but its southwestern limits into the lake are not yet defined.

... **The fourth hotspot** in the new acreage is along the eastern border of the lake where a number of companies bid in the small national reserve blocks offsetting old Mene Grande acreage.

When the Venezuelan Government opened bidding on several of these blocks last year, Meneg already had started drilling its Ceuta 1. The company has never revealed any production figures on the test; but it blew out, caught fire, and had to be extinguished. Reports indicated the well flowed at the rate of 10,000 bbl. daily while it was blowing wild.

Since that time three offsets to Ceuta 1 have been started. To the west about 3½ miles a seven-company group headed by San Jacinto Oil Co. has drilled into more than 125 ft. of lower Miocene pay below 11,000 ft. (OGJ, Aug. 19, p. 113). The group plans to drill the well to the Eocene or at least 13,000 ft.

San Jacinto has a 30 per cent interest in the tract and is operator. The group acquired the 2,000-acre tract from Venezuela Leaseholds, C.A.

To the north and west of Ceuta 1, the Shell company is drilling a test on Lot V-574, the 10,185-acre national reserve block for which it paid more than $28 million (second only to the bonus paid by Superior).

Shell spokesmen in this country say only that the well is drilling. Reports from Venezuela indicate a producer.

To the east and slightly north of Ceuta 1, the Sun-Atlantic-Seaboard group is drilling a test on the 2,078-acre portion of V-574 which it acquired from the original bidder, Venezuelan American Independent Oil Producers Association. There have been no reports on this well.

Canadians Seek Oil-Tax Relief

OTTAWA.—The Canadian Petroleum Association is asking the Canadian Government to rewrite the depletion allowance section of the income tax law to encourage more locally financed exploration for oil without, at the same time, discouraging foreign capital.

The C.P.A. is dramatizing its request for tax relief by citing a set of figures comparing income taxes paid by Canadian and U. S. companies. The comparison shows striking advantages for the U. S. companies over Canadian companies.

The proposed amendment to the income tax law was laid before Prime Minister John Diefenbaker and Finance Minister Donald Fleming by R. C. Brown, chairman of C.P.A.'s board of governors, C.P.A. General Manager John W. Proctor, and others.

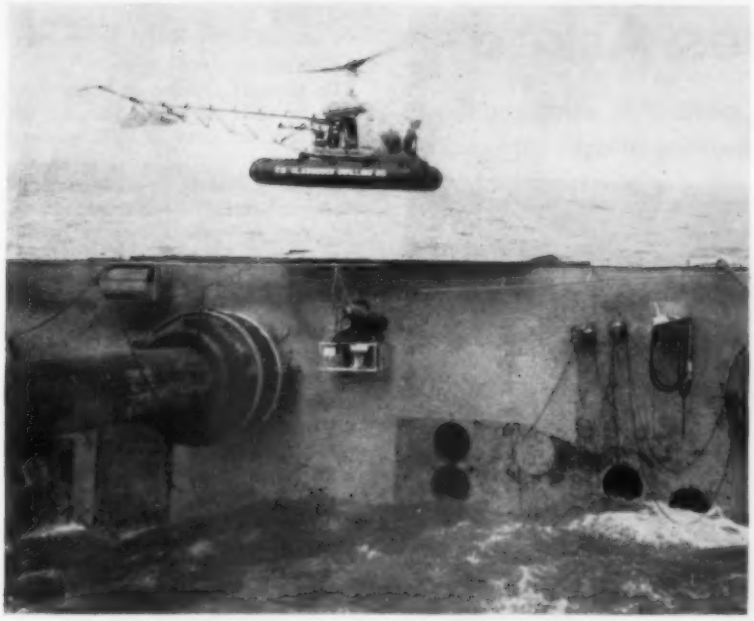
The principal recommendation is that an oil company be granted a depletion allowance of 25 per cent in the gross proceeds of oil and gas production. Under present law companies are granted a 33⅓ per cent net depletion allowance.

Gross depletion, argues C.P.A., is "the fairest method because it extends to all the riskers of capital in exploration and development the same provision for depletion . . ." Also it would place on the same footing the producing companies and the integrated companies, as well as the foreign-controlled companies.

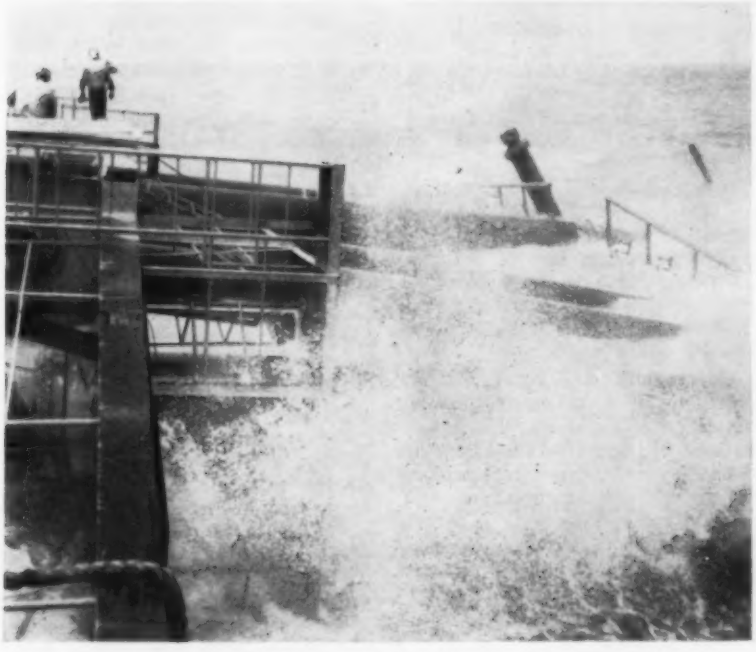
"The recommended changes in Canadian tax policy are aimed at equalizing the competitive position of Canadians, without at the same time inhibiting the flow of foreign capital," the C.P.A. says.

To support its contention that Canadian companies now are placed at a tax disadvantage, compared with United States companies, C.P.A. is relying on a government-sponsored income tax study showing taxes which would be paid by four types of companies spending about one million dollars annually for 10 years.

The analysis, prepared by Toronto accountant J. Grant Glassco, states that a U. S. company operating in the U. S. would pay the U. S. $682,000 in income taxes. The same company operating in Canada but having other U. S. income would pay the U. S. and Canada combined $900,000. In contrast, a Canadian company having substantial marketing income but no other production would pay Canada $1,195,000. And a Canadian company having no marketing or refining income would pay Canada $1,376,000.



Salvage crews land on platform's side and . . .



Cut up the upper deck for separate towing as . . .

Mr. Gus Goes Ashore in Pieces

CORPUS CHRISTI. — If weather remains favorable, the lower hull of "Mr. Gus" is expected to be salvaged within another week.

The upper hull of the big offshore drilling platform was cut up and hauled ashore as scrap after a backlash from Hurricane Audrey made salvage intact impractical. C. G. Glasscock Drilling Co. was patching the lower hull last week preparatory to refloating it. The hull then will be towed to shore for possible reuse.

The big mobile platform collapsed in the Gulf of Mexico April 3. The costly salvage job started soon afterwards, but it has been delayed repeatedly by rough water.

C. G. Glasscock, Jr., vice president of the tidelands firm, which owns the platform, said most of the drilling equipment such as engines, mud pumps, rotary tables, and crown block had been salvaged and was in surprisingly good condition.

As pieces of machinery were pulled from the 40-ft. sea, they were immediately submerged in large tanks of fresh water, thus preventing the double-corrosive action of salt water and air.

Shale Picture Good

New studies push reserve estimates up 50 per cent

LARAMIE, Wyo.—Experts are taking a second look at Colorado's oil-shale reserves, and the picture is much rosier than it was in the past.

The U. S. Bureau of Mines has re-estimated Colorado's reserves at 1½ trillion barrels of oil. This is 50 per cent higher than the bureau's trillion-barrel estimate last year.

The new appraisal of Colorado's oil-shale potential was made by Kenneth E. Stanfield, supervisor of oil-shale composition, analysis, and resources studies at the Laramie experimental station. The trillion-barrel estimate was made in 1956 by John R. Donnell, bureau geologist at Denver.

Stanfield said some oil-shale beds are tremendously thicker than first believed. One area—thought to contain between 150 and 200 ft. of high-grade oil shale—is known to have beds between 1,500 and 2,000 ft. thick.

Although major oil companies hold extremely rich oil-shale lands, Stanfield said the greatest deposits apparently lie in public domain lands north and west of the oil companies' holdings.

At least two townships in Rio Blanco County contain deposits so rich that 1 sq. mile would yield 2,250,000,000 bbl. of oil, he said. Wyoming and Utah outrank Colorado in the number of square miles of oil-shale area in the Green River formation. But Colorado's deposits appear to be much thicker and richer than outcroppings in the other two states.

The new estimate for Colorado is based on 50,000 oil-shale samples taken by the bureau and by private oil companies. The bureau counted only that shale containing 25 gal. of oil per ton. The dividing line between usable and nonusable oil shale is generally considered to be 15 gal.

New Oil Probes Asked

● O'Mahoney asks attorney general to study pipelines, Aramco, and residuals; subcommittee attacks import plan

WASHINGTON.—The Department of Justice was asked last week to take on three new oil investigations.

Sen. Joseph C. O'Mahoney of Wyoming said his recent oil investigation showed several areas in which antitrust action might be needed. In a letter to Atty. Gen. Herbert Brownell he called for:

. . . **Immediate investigation** of domestic pipelines to see if there is any monopoly of common carrier pipeline transportation.

. . . **Study of the joint ownership,** purchase and operating agreements among Arabian American Oil Co. and its four owning companies to see if they result in restraining of foreign commerce.

. . . **Inquiry to find** whether importers of residual oil have engaged in pricing practices violating the antitrust laws.

JOSEPH C. O'MAHONEY
. . . he wants to dig deeper

Import plan attacked . . . O'Mahoney's antitrust subcommittee last week attacked the voluntary import-control program and called it illegal.

The subcommittee issued a lengthy majority report on its oil investigation last winter.

The Senate inquiry started out as a study of the European oil lift following the Suez Canal closing last year. But it quickly spread to an over-all probe of the industry, at home and abroad. It wound up in June with a unique public reading of the staff's report and recommendations for Justice Department and congressional action.

The staff report carried 28 points of criticism of the oil lift, domestic pipeline operation, foreign activities, etc. (OGJ, June 17, p. 104). All of these plus three new ones, are carried in last week's majority report.

Seek more action . . . The report called for the federal grand jury at Alexandria, Va., to investigate possible violations of law by importers seeking to raid coal markets through control of residual fuel prices. The report also called on Congress to write a national oil policy.

The summary of the probe given the full Senate judiciary committee by O'Mahoney consists of an eight-page report by the majority, the four reports of the staff previously released, and dissents by Sens. Everett Dirksen of Illinois and Alexander Wiley of Wisconsin.

Both Dirksen and Wiley, countering O'Mahoney's criticism, defended the industry's efforts to supply Europe when Middle East oil was cut off. Dirksen also defended the crude price increases made last January, but Wiley joined the majority in condemning them.

The "volatile conditions" in Syria underline the importance of the oil lift section of the report, O'Mahoney declared. He urged the administration to take an active part in negotiations for an oil pipeline bypassing that country "rather than leave it to private oil companies to make the necessary commitments involving crucial foreign policy decisions affecting our world position."

Antitrust violation? . . . The only important new matter in the report dealt with the import program. The majority charged that it raises serious antitrust law questions.

"It has definite anticompetitive implications and tends to preserve the market position of the international oil companies," the report charged.

"A flat percentage cutback imposed on the major importers, predicated upon a historical base period, perpetuates the market shares which the Department of Justice charged in its cartel suit against these importers were arrived at by illegal agreements for dividing up world markets."

The plan is lacking in other respects, as well, the report asserted. It discourages the entry of new importers and the growth of small ones because the "dominant international oil companies" must be persuaded to move over to make room for them.

The high import quotas of the majors give them a bargaining point in dealing for new foreign concessions, said the report. And since the plan covers only crude oil, the international companies can refine in their overseas plants and shift their imports from controlled crude to uncontrolled products.

Oil lift controversy . . . In adopting its staff report on the oil lift, the subcommittee went along with the charge that the Middle East Emergency Committee operated under doubtful legal authority and that the Government failed to require strict antitrust safeguards and to eliminate conflict of interest.

Dirksen's dissent defended the oil lift in almost the same terms used by the Middle East Emergency Committee in its final report last month.

"To say that some other plan might have been better is like saying a substitute would have been better after the regular player has just hit a game-winning home run," Dirksen said.

The oil lift was based on the system used in World War II, the Korean war and the Iranian crisis, Dirksen pointed out. An "experiment" with "some untried scheme" in the Suez crisis would have been "gambing recklessly with the economic stability of our allies in Europe."

Wiley said he also could not agree with the "extreme criticism" of the oil lift by the majority. But he said neither did he agree with Dirksen's support of the price increases by the oil companies.

"They did take undue profit from an international oil transportation crisis which the U. S. Government had asked them to solve," Wiley said.

Scope of report . . . The many "conclusions and recommendations" in the majority report actually cover only a few subjects.

Sixteen deal with the oil lift and last January's price increases. Five apply to Arabian American Oil Co. and foreign operations generally. Three are based on the immunity granted by the Justice Department for special programs. Two relate to the import-control program and another two to pipelines.

Foote Stands Pat

Oil man won't give up his savings for a federal job

WASHINGTON.—Whether a man should be asked to strip himself of a good part of his life savings to take a government post has become a knotty problem for the Senate.

Men appointed to high offices now are required to divest themselves of all interests in companies with which they may have to do business. The purpose is to avoid a possible "conflict of interests."

Dr. Paul D. Foote, retired vice president of Gulf Oil Corp., has put the problem of how far that policy should go right in the lap of the Senate armed services committee. He told the committee he could not give up his Gulf pension or sell his oil stocks to become Assistant Secretary of Defense for research and engineering.

His pension and oil stocks are a "substantial part" of his life savings, the 69-year-old nominee said. The defense post to which he was named last month by President Eisenhower has no part in procurement or letting contracts, he pointed out. In any event, he said, he would not take part in any matter that might involve companies in which he held stock or had past associations.

Action on Foote's appointment was deferred by the committee. Chairman Richard B. Russell of Georgia admitted that it raised a valid question. New policy decisions on possible conflicts of interest will be studied, he said.

Failure of the Senate to confirm Foote need not keep him from taking the government post. He may be given a recess appointment by Eisenhower. In that way he could serve until he was confirmed or turned down by the Senate next year.

Alaskan Well to Be Tested

ANCHORAGE. — Richfield Oil Corp. has reached total depth at 12,384 ft. on its Kenai National Moose Range wildcat 40 miles southwest of here.

After setting 5½-in. casing to 12,000 ft., the operator plans to perforate for testing.

On an earlier formation test at 11,140-70 ft., the well, 1 Swanson River Unit, flowed 31°-gravity crude at a rate of 200 bbl. daily. Richfield now reports it has about 550 ft. of sand and shale section between 11,130 ft. and 11,700 ft.

watching WASHINGTON

. . . with Bertram F. Linz

Oil scores with atoms . . .

THE oil industry has taken the lead in the industrial use of atomic energy and it is paying off in a big way.

Savings through the use of radioisotopes are estimated at something between $140 and $215 million a year. This is nearly half of the total saved by all industry with this new tool of the atomic age, according to the Atomic Energy Commission.

Radioisotopes are used in acidizing control and evaluation, injectivity profiles, interwell tracing, cement top location, cement channeling, casing-seat channeling, casing leaks, permeability surveys, fracture location, and lost-circulation location.

The AEC estimates that the probable low and high savings of the industry are $14 to $16 million a year in oil-well logging, $120 to $180 million in oil-well stimulation, $500,000 to $700,000 in pipeline oil flow, and $5.3 to $10.1 million in refining.

New industrial uses for isotopes are constantly being found. One of the most important recently was for heatless vulcanization of automobile tires without the addition of sulfur. This was the first basic change in the curing of rubber in 118 years. The radiation-vulcanized tire reportedly wears longer and resists deterioration better.

End to government tankers? . . .

A SENATE committee is planning to take a hard look at a billion-dollar-a-year business in which Government competes with private industry.

That billion dollars is the cost of the military air and sea services. The latter is run by the Military Sea Transportation Service.

The committee will go into four points: (1) the relative cost and efficiency of the services compared to those of private companies, (2) the extent they can be taken over by private industry without hurting defense needs, (3) whether they have weakened our air and shipping industries, and (4) the tax lost by the Government by reason of its own operations.

The MSTS hires private tankers when the load is too heavy for its own fleet. Some in Congress believe the tanker industry could take over all oil-hauling for the military with big direct savings to the Government and increased tax revenues.

New ban for old nemesis . . .

THE Interior Department is looking for a cure for one of its biggest headaches—the 40-acre-lease broker.

The 40-acre broker is the fellow who used to advertise the get-rich-quick possibilities of small tracts of public lands which might turn out to be in the middle of an oil field. Until mid-1952, 40-acre leases could be filed with the Bureau of Land Management, and its offices couldn't keep up with the flood.

When the department ruled that leases could be leased only for 640 acres or more, these brokers switched their tactics. They began to apply for maximum leases of 2,560 acres. These they broke into 40-acre interests which they sold. More than 1,000 such assignments are being filed with the BLM offices each month.

Oil operators seeking to put together blocks for exploration have to chase down dozens of these assignees, scattered all over the country, who frequently hold out for high prices.

The department now has a plan to clean up this situation. The plan was worked out by Lewis E. Hoffman, BLM minerals staff officer who recently retired. It calls for a ban on assignments of less than 640 acres.

The Mineral Leasing Act will have to be amended. The department will probably ask Congress to make the change next year.

Orco Pins Hopes on Carbonated Flood

● Big oil recovery expected in first full-scale project. Orco tells how carbon dioxide forms surface-active agents in formation and brings about miscible-phase effect.

BARTLESVILLE, Okla.—Operators of the first full-scale carbonated-water flood are confident they will recover twice as much oil by using carbon dioxide to help sweep the reservoir.

After years of lab work and pilot projects, Oil Recovery Corp., New York, is finally taking its Orco process into the field on a commercial basis. The project is under way on a 240-acre stripper lease northeast of here.

This won't be the first time the industry's attention has been called to the possibilities of carbon dioxide in secondary recovery. The pros and cons have been batted around for years. In fact, the Pennsylvania Grade Crude Oil Association has carried out extensive lab tests at Bradford (OGJ, Nov. 3, 1952, p. 64).

But the industry, so far, has shied away from the "fizz" method, turning to the firmer footing of ordinary or brine water floods, natural-gas drives, and more recently L.P.G. floods.

Orco is shooting for a combination of effects: Water's ability to sweep a wide area, and L.P.G.'s ability to displace a high percentage of the oil in place.

Orco thinks that carbonated water will do the trick of recovering twice as much oil on a per-acre basis as the average water-flood program in the Bartlesville area. To prove it, Orco and its partner, Wellsville Oil Co. of Wellsville, N. Y., are not only carrying out the program in northeastern Oklahoma but are looking for more acreage suitable to the Orco process.

Engineers with Orco say the process has "a potent group of beneficial effects." The carbon dioxide will:

. . . **Act as a wetting agent** throughout the entire sand body.

. . . **Have a miscible-phase effect** on the pay zone.

. . . **Increase water-injectivity rate.**

And what's more, these effects can be brought about economically.

How it works . . . Here's what Orco says the carbonated flood will do:

Carbon dioxide forms surface-active agents that help sweep more of the oil and gas from the sand surfaces on which it had been adsorbed. These agents are formed by reaction of the carbonated water with the hydrocarbons and the minerals of the sand.

Thus, the inexpensive carbonated water makes it economically possible to treat the oil sand with surface-active agents all the way from injection well to production well. This effect is not possible by adding wetting agents externally, because the agents adsorb onto the rock a short distance from the injection well bore.

This complex action of carbonated water in Orco pilot floods brought about a big increase in gas production. Orco pilots showed that the amount of natural gas produced with the oil is more than 10 times greater than what an ordinary water flood produces. Furthermore, the gas is surprisingly rich.

Oil produced in tests has shown no evidence of having been "topped." The gravity of the Orco-processed oil has been the same as that of the oil produced with a normal water flood.

This sharply increased production of natural gas and L.P.G. mixture "was originally adsorbed on the surfaces of the oil formation and was released by the advent of the carbonated water and its induced chemicals to form a wave of lighter hydrocarbons" which move ahead of the flood front of carbonated water.

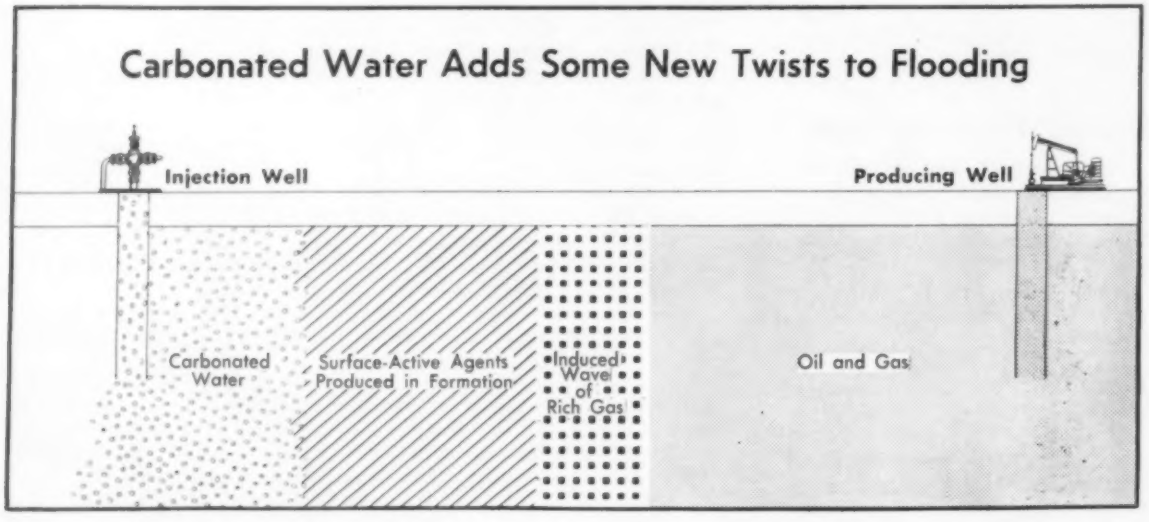
This wave at the front of the water flood, say Orco engineers, "is under full flooding pressure and will act as would any miscible-phase flood."

And, they add, this advantage of the miscible-phase effect does not require the cost of buying and compressing the rich natural gas.

Increased injectivity . . . Orco's experiments show that in sands of low permeability from two to more than three times the volume of carbonated water could be injected into a well under the same pressure.

This increased rate continued for several years after the carbonated-water injection phase of the flood had been completed and plain water was being used.

Such readiness to invade tight sands has the marked advantage of increasing flood efficiency, particularly where tight sands or lenses of tight sand



are prominent in the permeability profile.

The Oklahoma project . . . James Wellford Martin, Orco vice president in charge of engineering, says the oil sand in the new flood in northeastern Oklahoma is similar to much of the Bartlesville sand in that section of the state.

The floodable oil sand lies below a thin section of gas sand and above a sand section high in water content. The sand is found at 1,300 ft. and has the normal water-flood potential for that area.

The flood will be carried out on a five-spot pattern. Water will be obtained from the Arbuckle lime found at 2,500 ft. The carbon dioxide required for carbonating the water will be generated at a plant on the lease. Wellsville and Orco acquired the acreage from John M. Kane and Russell Straight et al., Bartlesville.

Orco has done research on over a thousand core samples from sands in almost all oil-producing sections of the country.

"We now feel prepared to proceed with confidence, for we have learned how to apply the Orco process, how to select reservoirs suitable for its use, and what we can reasonably expect to obtain because of its use," Martin said.

Orco apparently doesn't plan to stop with the Bartlesville project. The company is looking around for more property that could be adapted to carbonated water.

Union Markets Shale Oil

RIFLE, Colo.—Shale oil produced by Union Oil Co. of California at its pilot retort north of Grand Valley is being used commercially for the first time.

Union Carbide Nuclear Co., subsidiary of Union Carbide Co., is buying 60,000 gal. of shale oil monthly for its fusion burner, uranium-drier furnace, and other heat processes. No alterations were made in converting to shale oil.

"Chemical analysis shows that shale oil has about the same caloric value as petroleum fuel oil," Harry C. Peterson, superintendent of the nuclear plant, said. "We may experiment later with modifications, but right now the shale oil is working just fine."

Union Carbide will continue to use shale oil until December, before the company moves into a new plant west of Rifle. Natural gas will be used at the new site. The shale oil source will be cut off sometime in December when Union winds up its current experimental runs at the retort.

Processing briefs

Canadian Petrofina, Ltd., will boost crude capacity at its relatively new Montreal refinery by 50 per cent. The $3-million project will give the plant a daily capacity of 30,000 bbl. Completion is set for the middle of 1958.

Douglas Oil Co. of California is on stream with a 1,300-bbl. U.O.P. Unifining unit at its 7,500-bbl. Bakersfield refinery. The unit will be used variously to produce high-quality kerosine and distillate oils from California crudes, as a pretreater to desulfurize naphtha derived from sour Santa Maria crude, and for processing thermal-cracked naphtha prior to charging to a 2,500-bbl. U.O.P. Platforming unit.

Members of the United Mine Workers union are back on the job at Ethyl Corp.'s Baton Rouge plant. They walked out July 9. During the strike, the plant was operated by supervisory and technical personnel.

Clark Oil & Refining Co. has started construction of a 12,500-bbl. U.O.P. fluid catalytic cracking unit and gas-concentration facilities at its 32,000-bbl. Blue Island, Ill., refinery. Clark is spending $7,250,000 to expand and modernize the plant. Procon, Inc., is the contractor.

Esso Standard Oil Co. has charged its 2,000,000,000th barrel of crude to stills. The firm's first crude run was made November 15, 1909. It took 37 years to process the first billion barrels, and only 11 years to charge the second billion. This volume represents nearly half the cumulative production in Louisiana since the Jennings discovery shortly after–the turn of the century.

Standard Oil Co. of California, Western Operations, Inc., will build a $250,000 natural gasoline deisobutanizer at its El Segundo refinery. The new facility will boost Standard-Western's isobutane production by about 300 bbl. a day. Completion is slated by December 15.

Tidewater Oil Co. has now had its new 42,000-bbl. fluid coker at Avon, Calif., in continuous operation since early June. This is the longest run completed by the unit since it was placed on stream late last year.

Wiseco Processing Plant, Inc., has started construction of its new $3,000,000 natural-gasoline plant near Bridgeport in Wise County, North Texas. The new company, a joint venture of Christie, Mitchell & Mitchell, Houston, and Warren Petroleum Corp., expects to have the plant in operation by January.

It will process gas from fields in Jack, Wise, and Parker counties and deliver it to Natural Gas Pipeline Co. of America for transmission through the latter's new 26 and 20-in. line from this area to its existing system in the Texas Panhandle. The plant will handle up to 150,000,000 cu. ft. of gas daily and extract at this rate about 220,000 gal. of propane, butane, isobutane, and natural gasoline a day.

Sinclair Oil & Gas Co. has started installing dehydration and desulfurization units at the Hulldale natural-gasoline plant 12 miles east of Eldorado in Schleicher County, West Texas. The new duties are being added to process the gas further so that it can be sold to Pioneer Gathering System, Inc., Amarillo. The plant, owned by Sinclair and Skelly Oil Co. and operated by Sinclair, has a gas-processing capacity of 25,000,000 cu. ft. daily. It is currently handling about 14,000,000 a day.

Also for Refiners . . .

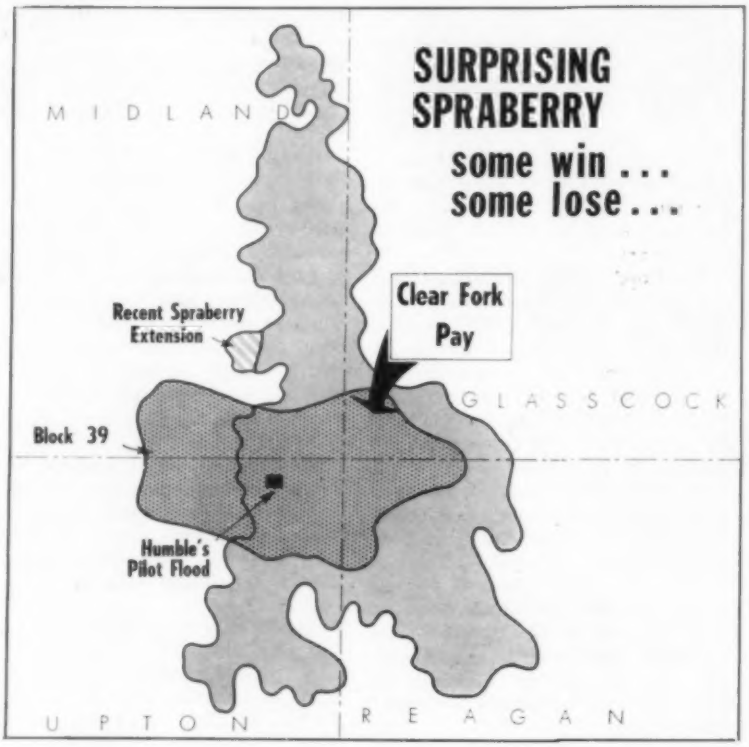
Latest federal survey puts Colorado's shale-oil reserves at 1½ trillion barrels (p. 85) . . . Senator O'Mahoney is asking Congress to probe residual importers to determine if they've engaged in pricing practices violating anti-trust laws (p. 86) . . . There's still room for growth and profits in petrochemicals despite the leveling off period faced by the industry (p. 94) . . . Socal is tying a computer into its every-day refinery operations (p. 96) . . . Referee Loeb recommends that New York Supreme Court disapprove sale of U.O.P. (p. 98) . . . First hearings are scheduled next week on protests to voluntary imports plan (p. 98) . . . Independent refiners pinched by sudden cutback in military oil purchases (p. 99) . . . West Coast refiners have started to cut back runs (p. 100).

PLUS THESE TECHNICAL FEATURES: Nelson's refinery cost index (p. 146) . . . There's a new digital computer for process control (p. 151) . . . On the Job . . . In the Plants (p. 163) . . . and COST-imating (p. 164).

Spraberry Finally Pays Off For Some

- Sohio and Magnolia are among the firms showing a profit—and water flooding may bail out others.
- But the picture isn't all rosy. Some operators still lose money in tight sands, uneven pay formations.

Robert J. Enright
Dallas District Editor



DALLAS.—Production surprise of the year: Some of the biggest plungers in the huge Spraberry Trend drilling boom of 1950-51 are now coming out of the red on their Spraberry operations.

In view of the gloom which has hung like a pall over Spraberry since the bubble burst in 1952, this comes as a major surprise.

But it's nonetheless true.

Sohio Petroleum Co., for instance, with more Spraberry wells than any other operator, is now edging into the black. Magnolia Petroleum Co. is another which eyes a Spraberry profit.

Furthermore, these and other operators are looking to future developments which might push up their trend profits from marginal to a level much more healthy.

One development is water flooding. Results of a current experiment in the trend makes prospects for Spraberry floods, once regarded as dim, look much brighter in the more heavily developed areas.

Unfortunately, though, many Spraberry operators, some of them majors, aren't in the same boat with Sohio. And it appears inevitable that some of them are going to take it on the chin with heavy Spraberry losses. One major is reliably reported to have been $7,000,000 in the hole in Spraberry 2 years ago—and circumstances since indicate the loss hasn't been cut much.

Why the difference? . . . How can one firm lose so much and another make a profit in the same field?

It's not hard in a field the size of Spraberry with its 400,000 acres sprawling over Midland, Glasscock, Upton, Reagan, and Martin counties. Conditions can vary greatly between points in an area this big, and they do in the trend.

Sohio, for instance, benefits because of three factors—at least two of them unforeseen in the boom days. The company:

. . . Got in early. Early Spraberry wells stood a greater chance of paying out than those drilled later because they drained a larger area. Later wells found much of the oil originally under the locations drained off. One operator determined that his poor producer was due to drainage from wells more than a mile away.

. . . Found lower Spraberry pay. The lower Spraberry doesn't produce throughout the entire trend area. It is productive mainly in the "four corners" and surrounding area where Midland, Upton, Reagan, and Glasscock counties meet. The upper Spraberry is the field's main producing zone underlying most of the trend. Operators lucky enough to have both are much better off, payout-wise.

. . . Got Clear Fork production. The Clear Fork, discovered in June 1955, has been a great boon to operators with near-depleted Spraberry wells. Contrary to the lower Spraberry, the Clear Fork is a shallower pay than the upper Spraberry and was available with no added drilling and for relatively small recompletion costs. Here, too, operators in the four corners area benefited most, because the Clear Fork centers in this region (see map).

The Clear Fork Phase

Trend operators fortunate enough to have Clear Fork pay, however, have now eaten about all its fruit.

The Clear Fork is about played out. Operators expected as much. It is a thin zone averaging about 10 ft., and some wells produce from as little as 5 ft. The pay also is poor—a shaly type, mostly calcite, with silty clay streaks (OGJ, Oct. 24, 1955, pp. 56-8; April 2, 1956, pp. 72-4).

Production from the Clear Fork reached its peak quickly in less than a year from the discovery. This was in May 1956, when 282 wells produced 488,376 bbl. for the month.

In June this year, after 2 years of production, Spraberry Trend Area Clear Fork field produced only 218,051 bbl. from 419 wells. And this figure is misleading. The bulk of this production is coming from about 70 wells in what is now called the Block 39 portion of the field.

This area lies to the west and out-

side of the limits of Spraberry sand production in the trend. In May 1956, when the trend Clear Fork output reached its peak, the Block 39 area was just discovered. It was regarded and regulated as a separate field and its production not included in the trend Clear Fork total. Since then, however, development proved it to be in a common pool, and it was consolidated into Spraberry Trend Area Clear Fork field.

Likewise this production in Block 39 doesn't help operators with Spraberry wells. The Spraberry in this area is barren of oil.

If the Block 39 area Clear Fork output were subtracted from the total, trend area Clear Fork production now would be at a meager level indeed.

Some are plugged . . . A large number of Clear Fork wells in the trend have been plugged off. Many more are producing only 1, 2, or 3 bbl. of oil a day. The field discovery, Rowan Oil Co.'s 1 Schwertner in northwest Reagan County, and its neighbors are in this category.

Normally, of course, oil wells of this uneconomic caliber are plugged. But there is another factor involved—gas. Gas-oil ratios of many Clear Fork producers have skied to 50,000 : 1 or even 60,000 : 1. The climbing G.O.R.'s in most cases aren't due so much to increasing gas production but to steady or slowly dropping gas production with plummeting oil output resulting.

Sale of the gas, though, is bringing in enough revenue to keep a considerable number of Clear Fork wells going. But this won't last long. The gas is expected to wear out soon.

Still a blessing . . . Though ill-regarded on its own merits, the Clear Fork in the trend has been as good as a gold mine to operators trying to pay out long-since-drilled Spraberry sand wells.

With its usefulness about done, operators now are able to judge more accurately what the shallow pay has been worth to them.

All told, the Clear Fork, to July 1 of this year, produced 7,257,064 bbl. of oil. Sohio, which estimates its Clear Fork production, is about 98 to 99 per cent depleted, alone has produced 1,431,000 bbl. of Clear Fork oil with its 70 wells, roughly a fifth of the output of the entire field.

Company engineers estimate that the first Clear Fork wells produced 30,000 to 40,000 bbl. of oil during their life and later completions about 18,000 to 25,000 bbl.

The cost of plugging back a well from the Spraberry to the Clear Fork and recompleting it averages only $5,000 to $7,500—so it's easy to see why trend operators have a warm spot in their hearts for the Clear Fork.

The Spraberry Problem

Clear Fork's older and deeper sister pay, the Spraberry sand, has changed little.

The Spraberry is still limping along, losing more wells and production each year.

The roughly 2,500 wells at the peak now have declined to 2,183. The slump in production is much more pronounced. From an approximate 26,000,000 bbl. in 1954, Spraberry output slid to 21,300,000 bbl. in 1955 and to only 18,300,000 bbl. last year. This is an average of about 23 bbl. per well per day, not very high for 8,000-ft. wells so young.

Down to 20 bbl. . . . Spraberry production this year likely will total only about 15,500,000 bbl., an average of less than 20 bbl. per well per day.

Engineers figure that for an operator to break even his Spraberry well must produce about 700 bbl. of oil per acre. This is a rough average since Spraberry wells produce from tracts ranging in size all the way from 40 to 160 acres.

They are able to say pretty definitely now that an operator can count on only about 500 to 550 bbl. per acre from the upper Spraberry, the main zone.

Thus the many trend operators with little or no Clear Fork or lower Spraberry are plainly still hurting.

One Spraberry veteran predicts that despite its aches and pains the big field probably will go on producing, at least in some areas, for another 10 to 15 years.

But he describes the operation already as a "milking" process. Operators are experimenting with all kinds of production techniques to squeeze out all oil possible. Some have found that they can produce more oil in a month's time by alternately opening and shutting in the wells rather than producing them steadily every day. Swabbing to restore production is common.

Pay still puzzling . . . Despite 7 years of production, Spraberry producers admit that even now they know little about the tight pay sand.

Many methods of increasing production pressure have been tried in the field with no great success. These include:

. . . Water fracturing, which may work in one well but not in the next. Hanley Co.'s A-2 Driver was given a huge jolt of 200,000 lb. of sand in 250,000 gal. of water. Production climbed to 80 bbl. a day and then fell back to its old level. Sand flowed back out of the pay into the well bore, and workovers erased what profit was made.

W. E. Bakke Co. tried similar treatments on two wells. One gave plenty of trouble—split the casing when the pay wouldn't take sand—but increased production to almost 200 bbl. daily. The other took the treatment smoothly but boosted production only slightly.

. . . In situ combustion. The extremely tight pay has forced abandonment of several experiments with new secondary-recovery techniques. Two years ago Sinclair Oil & Gas Co. abandoned a pilot fire flood when it was unable to get a burning front going in the Spraberry and gave up after a couple of down-hole explosions.

. . . L.P.G. injection. Phillips Petroleum Co. suspended L.P.G. injection when bottom-hole pressure became so great that pump capacity was insufficient to force further L.P.G. into the formation. This occurred after only relatively small volumes had been injected and at several input wells.

. . . Water imbibition. The first water flood in the Spraberry, operated by Atlantic Refining Co. in the Driver area, was only moderately successful and was abandoned in 1956. An Atlantic official said the project was not expanded to a larger area because other firms were reluctant to participate.

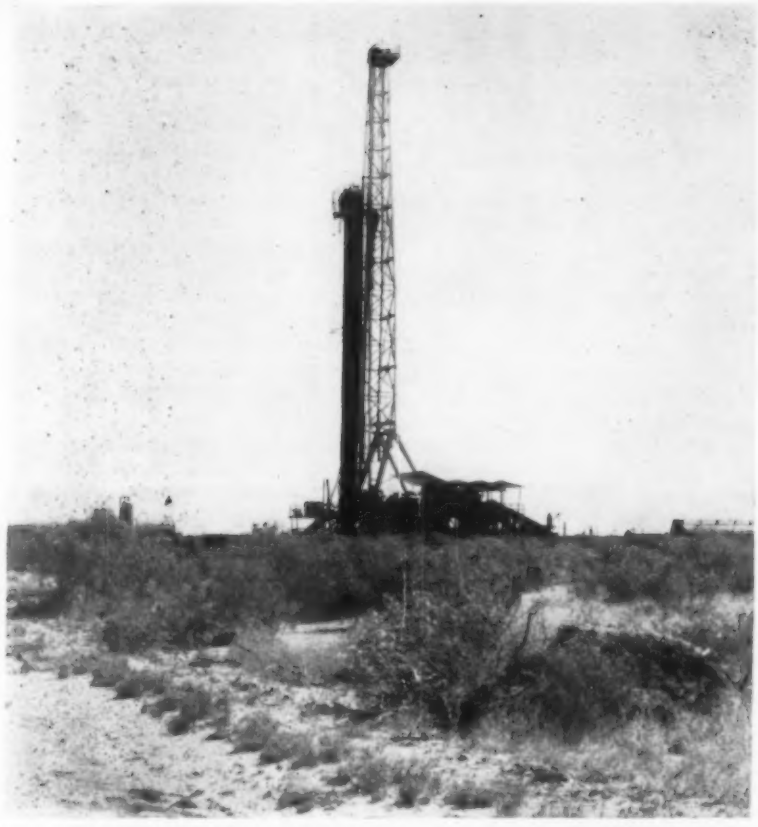
Atlantic believes the test proves water flooding profitable for the Sprayberry if others will join the project.

The Spraberry confounds operators in other ways, too. Hanley and others have run gamma-ray logs in producing wells and, in each instance, directly opposite the pay, the log record nearly jumped off the paper. This indicates to Hanley's production superintendent, Frank Forsythe, that some sort of radioactive salt or sulfate has developed on the face of the pay to interfere with flow of oil out of the sand.

Still some drilling . . . Surprisingly, in view of the operator discouragement over Spraberry for the past several years, there again is a fair amount of drilling going on there.

Most of it is being done by independent operators. But some majors are drilling, too.

Recent drilling has added about 3½



NEW SPRABERRY PROJECT symbolizes trend's return to good graces of some operators. Respectable number of rigs are running again. Some of them, like this one drilling for Magnolia, are on location for major operators, most of whom haven't done much drilling at Spraberry for a long time.

sections, 2,240 acres, to the west edge of the field in the Driver area of Midland County.

Aside from this campaign, most of the Spraberry drilling has been scattered. New locations are being staked and drilled in all four counties. Generally, however, they are selected carefully . . . most of them going down in areas where chances are best that the operator will find both Spraberry zones and perhaps the Clear Fork, too.

Some of the drilling is believed due to new optimism which stems from knowledge that at least some Spraberry operators have pushed over into the black. Also growing experience is breeding more confidence.

Flood May Be Solution

And then there is Spraberry's new big hope. This is the plain old everyday garden variety water flooding—the thing that wasn't supposed to be any good for Spraberry.

A pilot operation launched in late 1954 in the North Pembrook area by Humble Oil & Refining Co. on its L. H. Shackelford "B" lease has upset this dope. Results of the Upton County project have excited holders of large, well-developed tracts throughout the field.

The pilot flood, basically a five-spot with four input wells, is reported to have hiked recovery from an estimated primary total of 500 bbl. per acre to roughly 1,200 bbl. per acre.

A recovery boost of this magnitude is big news in Spraberry. It could change the outlook for the big field entirely, making profitable propositions out of leases which before looked like lemons.

Humble had injected roughly 3,000,000 bbl. of water through the four inputs at the first of May this year. The center producing well, its Shackelford B-9, had produced 101,694 bbl. of oil and 108,700,000 cu. ft. of gas to the first of April. The well is averaging a little under 50 bbl. of oil a day.

Other producers on this lease and on adjoining leases of other companies have stepped up production, too.

Such a yield looks mighty big to some operators who previously had looked for no more than 15,000 bbl. per 40-acre well.

Impressed by the results of the Humble flood, several other majors already are flanging up plans to kick off floods late this year or in 1958. They include Magnolia, Sohio, and Sinclair. Magnolia has the lease next to the Humble pilot and got a production boost from it.

The Sohio project involves unitization and likely will be large.

All of the planned floods will be in well-developed areas of Spraberry—most likely in the Driver area and centering around the four corners.

A Humble source said he felt that, though results of the pilot were good, they were not good enough to influence anyone to drill up acreage to start a flood.

The main thing is that the pilot has proved that a conventional five-spot flood will work and that it can be profitable. The flood oil output is now declining to about 80 bbl. daily from several hundred barrels a day at its peak. But it has proved its point.

It is a tonic for Spraberry operators still in red ink, and further brightens the outlook for those who have just emerged.

Canadian Gas Sold

Shell will supply gas to California line in 1960

CALGARY. — Shell Oil Co. has contracted to supply half the gas requirements of the 1,300-mile, $330-million system that will carry gas from Alberta to San Francisco.

Shell will supply some 200,000,000 cu. ft. daily to the newly organized Alberta & Southern Transmission Co., Ltd., which is due to start operating in 1960. The gas will come from Waterton, Sarcee, Crossfield, and Homeglen - Rimbey fields. Shell will sell Alberta & Southern any gas it discovers in Alberta for the next 10 years under terms of the new contract.

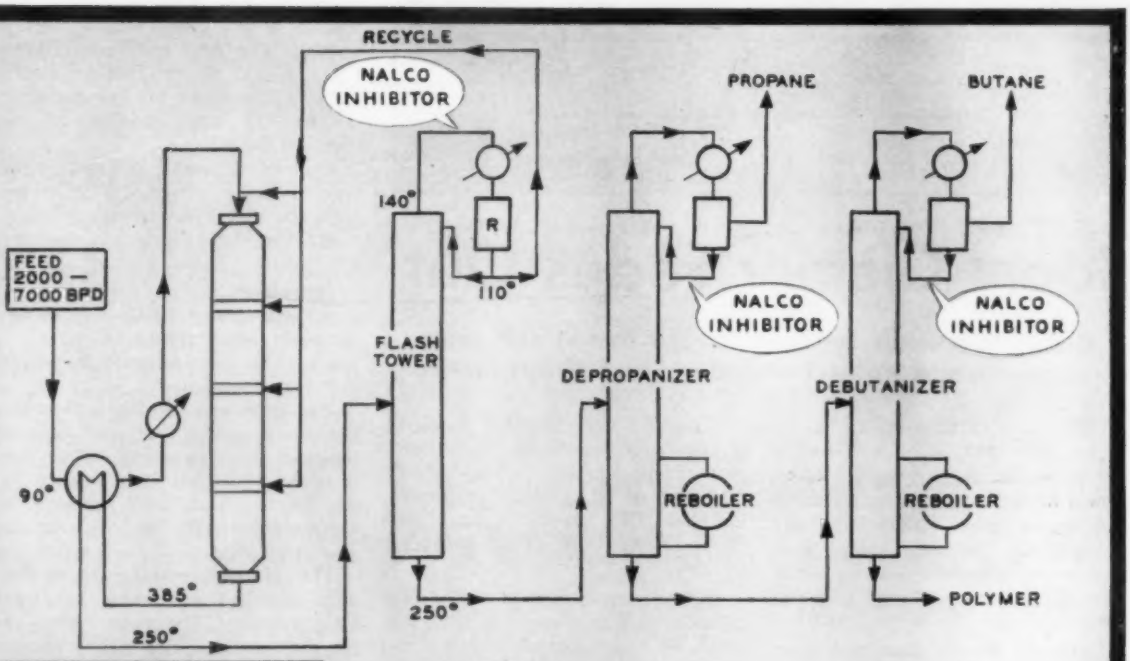
Prices as high as 15 cents a M.c.f. have been reported for Alberta gas as a result of competition betwen Alberta & Southern and Westcoast Transmission Co., Ltd. (OGJ, July 22, p. 64). The Shell prices were not disclosed.

Jack K. Horton, vice president of Pacific Gas & Electric Co., which organized Alberta & Southern, has been elected president of the company and will move to Calgary. J. B. Black, P.G.&E. chairman, is chairman of the Canadian affiliate. S. M. Blair, president of Canadian Bechtel, Ltd., is vice chairman. Six Americans and seven Canadians were named to the board of directors.

Nalco INHIBITORS

STOPPED CORROSION and FOULING

in this CATALYTIC POLYMERIZATION UNIT



THE PROBLEM

1. *Corrosion* of the steel tube bundles of the flash tower overhead condenser with accumulator water pH of 4.5 or below.
2. *Serious fouling* of screen trays in the depropanizer and debutanizer on normal six-month run.

THE TREATMENT

Nalco Inhibitor fed to the overhead of the flash tower, and to the reflux of the depropanizer and debutanizer towers.

THE RESULTS

1. Iron content of accumulator water reduced from .75 pounds per day to .04 pounds per day.
2. No deposits in screen trays after six-month run.

CONSIDER further the economy of dosage . . . 10 ppm to flash tower, and 10 ppm to depropanizer and debutanizer. And bear in mind that this was no isolated success story. The same advantages—less downtime, better thruput *and* effective protection for costly equipment—can be brought to your refinery by the use of Nalco Corrosion and Fouling Inhibitors. Ask your Nalco Representative or write direct.

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Petrochem Output Will Make Some Big Jumps by 1965					
Production (billion lb.)	1956	1960	Indicated rate of growth	1965	Indicated rate of growth
Aliphatics	22.1	31.0	9.0%	52.0	11.0%
Aromatics	3.6	5.3	10.0%	9.0	10.5%
Inorganics	9.3	11.7	6.0%	19.0	10.0%
Total	35.0	48.0	8.7%	80.0	10.5%
Per cent of chem. output	25.0	32.0		42.0	
Per cent of chem. revenue	50.0	60.0		65.0	

Boom Glamor Fades Out

● Petrochemicals levelling off but there's still room for growth and profits, Harvard research study predicts

THE PETROCHEMICAL section of the oil industry may experience a less spectacular but nonetheless steady growth in the next 8 years.

A boom glamor which has surrounded petrochemicals in the past may be fading and the industry shows signs of stabilizing. Plenty of room for growth and profits still exist.

That's the outlook contained in an extensive study of petrochemicals made by researchers for the Harvard graduate school of business administration. The report predicted:

... **Petroleum will continue to grow** as a source of chemicals.

... **Rate of return** on petrochemical investment is levelling off but is moving more in line with other chemical investments.

... **Breakeven point** in petrochemical plants is rising.

... **Competition** is getting stiffer as more oil companies enter the field.

Future growth . . . Petrochemicals still can be characterized as an excellent growth industry in spite of signs that a levelling off has set in.

The Harvard study concluded that petroleum will continue to grow as a major source of chemicals. It painted this picture of the future: In 1956 about 25 per cent of chemicals produced in the United States was based on petroleum. This figure will rise to 32 per cent by 1960 and to 42 per cent by 1965 (see chart).

Value of petrochemicals produced is even more significant. These compounds represent about 50 per cent of the value of all chemical production last year. They should represent two-thirds of the value of all chemicals by 1965.

Harvard researchers predicted that petrochemical production in 1960 will reach 48 billion pounds and will exceed 80 billion pounds by 1965. At these levels the rate of growth will be 9 per cent for the next 3 years and then about 10.5 per cent.

The Harvard study shows the rate of petrochemical expansion in the last 10 years has averaged about 12.5 per cent—slightly below the 14 per cent rate generally accepted in the industry.

The past growth of petrochemicals has been spectacular as witness these figures:

... **Production** rose from 10 million pounds 30 years ago to nearly 40 billion pounds yearly now.

... **Petrochemicals now account** for 80 per cent of the aliphatics and more than one-third of the aromatic chemicals.

... **3,000 petrochemical compounds** are now marketed and nearly 1,000 of these are shipped in tank-car lots.

... **400 new products a year** are wholly or partly petroleum derived. These new products plus expanded uses of older ones have provided the stimulus for petrochemical growth.

Profits off? . . . There is a general impression that the petroleum industry is growing less profitable than it has been in the past.

The Harvard study reported the consensus among oil companies is that a petrochemical investment must return 15 per cent after taxes. Oil men demand a higher return on these outlays than on refining investments.

The justification for higher returns is the belief that greater risks exist.

However, the economic study pointed out the petrochemical industry has reached a new position in its development. The next few years should see a period of stabilization. Profit margins have eased off but are more in line with other segments of the chemical field.

This development is justified by several factors. Operators have become familiar with the strange processes. They have developed markets. The risks have been reduced.

Petrochemical investments, however, still remain tricky due to the relatively high breakeven point in plants. This has increased as investments have gone up.

The breakeven point in a plant has moved from about 50 per cent of design capacity to nearly 75 per cent in 1954. This has been caused by two trends: A declining price curve for petrochemicals and stiff increases in cost of plant.

The Harvard researchers emphasized that oil companies have not fully exploited the opportunities in the petrochemical field. They pointed out that oil men very often do not think in terms of chemicals. They are in an excellent position to participate in processing chemicals from refinery streams. This would allow them to upgrade petroleum fractions to profit levels beyond conventional refinery margins.

The study declared that long-term projections for petrochemicals should not be influenced too heavily by two expected factors:

... **Stiffer competition.** This expected development is not believed an unhealthy trend.

.. **Present overcapacity** in some segments. This is considered only a temporary situation which will be changed when markets catch up.

Raw materials outlook . . . The Harvard report also provided some interesting observations on the sources of raw materials and building blocks to be used in the future by the petrochemical industry.

The outlook on raw materials:

... **Natural gas** will be limited in its use for chemicals. Main explana-

The Raw Materials . . .

Source (1955 figures)—	Annual output	Converted to pounds	Pounds used in petrochemicals	Per cent of source	Per cent of petrochemicals
Natural gas	10,278,000 M.M.c.f.	500 billion	5.0 billion	1.0	20.5
L.P.G.	5,240 million gallons	26 billion	6.6 billion	25.0	27.0
Refinery gases	2.56 billion barrels	800 billion	12.8 billion	1.6	52.5
			24.4 billion		100.0

Sources: U. S. Bureau of Mines, U. S. Tariff Commission.

The End Products . .

	Projected production (millions of pounds)	
Industry—	1960	1965
Rubber	1,800	2,500
Plastics	6,500	9,200
Detergents	3,500	5,200
Fibers	850	1,300
Ammonia	7,500	13,500
Carbon black	2,200	3,300
Sulfur	2,000	2,800

These figures are not additive. There is some overlapping and double counting.

tion given for this is the uncertainty for procedures caused by government regulations and unpredictable price levels expected in the future. Natural gas probably will be priced out of the chemical market when it hits 20 cents per M.c.f. Its use also is limited to plants near producing areas because of transportation costs.

. . . **High olefin refinery streams** will be the main suppliers of chemical feed stocks in the future. They may not increase their penetration of the materials market, however, due to: (1) Their competitive use for upgrading gasoline octanes, (2) conflict of interest between oil companies and chemical firms, and (3) the awkwardness of handling them far from refinery locations.

. . . **L.P.G. and other light hydrocarbons** should increase in importance in the chemical market. They are more flexible in location, less expensive to transport, more suitable to long-term contract, and their chemical composition is more economical for processing.

And speaking of basic building blocks, which of these petrochemicals will get the play in the future? The Harvard study gave this outlook:

. . . **Methane,** whose most important source is natural gas, will rise or fall with the success of its historic products, such as methanol. Methane will be important, however, as a source of synthesis gas—hydrogen and carbon monoxide.

. . . **Ethylene** will continue to be the important building block in the petrochemical industry. Future uses and demand can be reasonably charted.

. . . **Propylene** has an encouraging future. Research is turning more and more in the olefin series to propylene. Developments such as the Montecatini polypropylene process make this building block much more important.

. . . **Butylene** is probably only in its infant stage It has continued bright prospects as the basic chemical for butadiene and butyl synthetic rubber.

. . . **All aromatics** derived from petroleum will continue to increase their substantial position in the chemical market.

Who uses petrochemicals? . . . The outlook for petrochemicals naturally stems from a healthy group of industries which use the compounds as raw materials. These include:

. . . **Synthetic rubber.** These companies have just completed another round of plant expansion. Present capacity will be able to supply the total U. S. new rubber requirements of 1.67 million tons in 1960. New developments just now coming on the scene, such as synthetic-natural rubber, give the industry much vigor.

. . . **Plastics and resins.** This group has had a fantastic boom in recent years. Production hit 4 billion pounds in 1956, a 6 per cent gain in 1 year. A 75 per cent increase is predicted by 1960 and by 1965 production should be 9.2 billion pounds. Polyethylene has been the bright star in this galaxy along with the vinyl and styrene plastics.

. . . **Synthetic detergents.** Production level of 3.5 billion pounds is predicted by 1960 and 5.2 billion by 1965. These estimates indicate an expected growth rate considerably below the 20 per cent annual growth achieved in the past.

. . . **Synthetic fibers.** Output should expand from present level of 600 million pounds to about 850 million by 1960, and 1,300 million pounds by 1965. Nylon should continue to be the leader although other fibers may trim its dominate figure some.

. . . **Ammonia.** Plant capacity has outstripped the market although sales have experienced steady growth. Output rose from 245,000 tons in the U. S. in 1919 to about 3 million tons in 1956. Capacity, however, was expanded to more than 4 million tons.

. . . **Carbon black.** Production in 1956 was 1,630 million pounds of which 450 million pounds went to overseas markets. Domestic demand has been satisfactory, but overseas markets have fallen off. Foreign countries have been expanding their own synthetic-rubber and carbon-black facilities. Based on anticipated rubber consumption, the market should be 2,200 million pounds in 1960 and 3,500 million pounds by 1965. Additional capacity will not be warranted until after 1960.

. . . **Sulfur.** This chemical recovered from sour natural gas and refinery gases got a boost in the early 1950's when the price of Frasch process sulfur rose so much sulfur recovery became attractive. Production of sulfur from petroleum sources was below 2 billion pounds in 1956. It will reach this mark by 1960 and hit 2.8 billion pounds by 1965.

Record Set Right:

Phillips' L.A.C.T. Is a Texas "First"

AUSTIN. — Somebody slipped up on their filing so a bit of Texas history went out of whack last month.

Texas Railroad Commission records showed that Shell Oil Co. was granted the first permanent permit to operate an automatic-custody-transfer system in Texas (OGJ, Aug. 12, p. 80).

But Phillips Petroleum Co. says it isn't so. The firm points out that it was granted a permanent permit June 24 for its Ranch "C" battery in Panhandle field.

For the week of August 6, Phillips says, the commission records showed that Shell's permit was the history-making first. The next week, however, the records were changed to show that Phillips was under the wire ahead of everybody else.

Phillips' Ranch "C" battery was installed December 19, 1956, and has sold more than 40,000 bbl. of oil automatically. The company's North Burbank unit in Oklahoma delivered its 1,000,000th barrel of oil automatically July 16, 1957.

Phillips now operates four L.A.C.T. units and has six others under construction.

Versatile computer watched closely as . . .

Socal Puts New Brain to Work

SAN FRANCISCO.—A new electric brain, with a flair for solving a big variety of down-to-earth problems for the oil industry, has gone to work for Standard Oil Co. of California.

The new tool is the oil industry's first high-capacity digital computer for widespread use in refining, production, transportation, and other operations.

It will be a year before sufficient work can be programed to keep the expensive machine busy for even an 8-hour shift. But Socal officials say the computer is justified if it keeps busy 1 hour a day.

The company is paying International Business Machines Corp. a yearly rental of $430,000 for the computer, known as the 704 Data Processing Machine. Nineteen technicians and programmers are operating the device. The staff will be enlarged as more is learned about the 704's talents.

What it does . . . Unlike other high-capacity computers in the oil industry, the new machine will not be used as a clerical or accounting device.

So far, the electric genius has excelled in calculation of gasoline blends. Through linear programing, the computer has set up the proportions of blending stocks which should be used to arrive at the most economical blends.

Another refining use will be stock-balance computations. The growing complexity of refining is making it impossible to carry out this work by present techniques.

In producing operations, the 704 will help determine optimum production schedules for oil fields. As a research tool, the computer will help find methods of predicting reservoir performance.

Socal also plans to use the computer for studies of drilling-platform design and well-logging devices, and for interpretations of well correlations.

Committee Reports on O.I.C.

FORT WORTH. — The future of the Oil Information Committee will be the subject of a report to the board of directors of the American Petroleum Institute here September 30.

A study committee, headed by Bruce Harbottle of Shell Oil Co., has completed its report on the oil industry's cooperative public-relations program. Members include J. E. Landroth of Standard Oil Co. (N. J.) and Harvey Cash of The Texas Co.

The study committee was set up under the A.P.I.'s policy, practices, and procedures committee.

The O.I.C. is the public-relations branch of the A.P.I. Just last month Adm. H. B. Miller, who had served as director of the O.I.C., resigned to accept a position with Pan American Airways. Phil C. Humphrey, Miller's assistant, was named acting director.

—— *Industry* briefs

Louisiana's oil production allowable for September has been reduced to 760,168 bbl. daily in the sixth consecutive monthly cutback. The September allowable, which State Conservation Commissioner John B. Hussey called the "rock bottom," is 8,862 bbl. below the August total.

C. C. Woodruff, Henderson, Tex., has sold his interest in Carter-Jones Drilling Co., Kilgore, Tex. Henderson reportedly received $600,000 for his share in the firm. Remaining partners in Carter-Jones are J. K. Maxwell, H. C. Jones, and W. T. Maxwell, all of Kilgore.

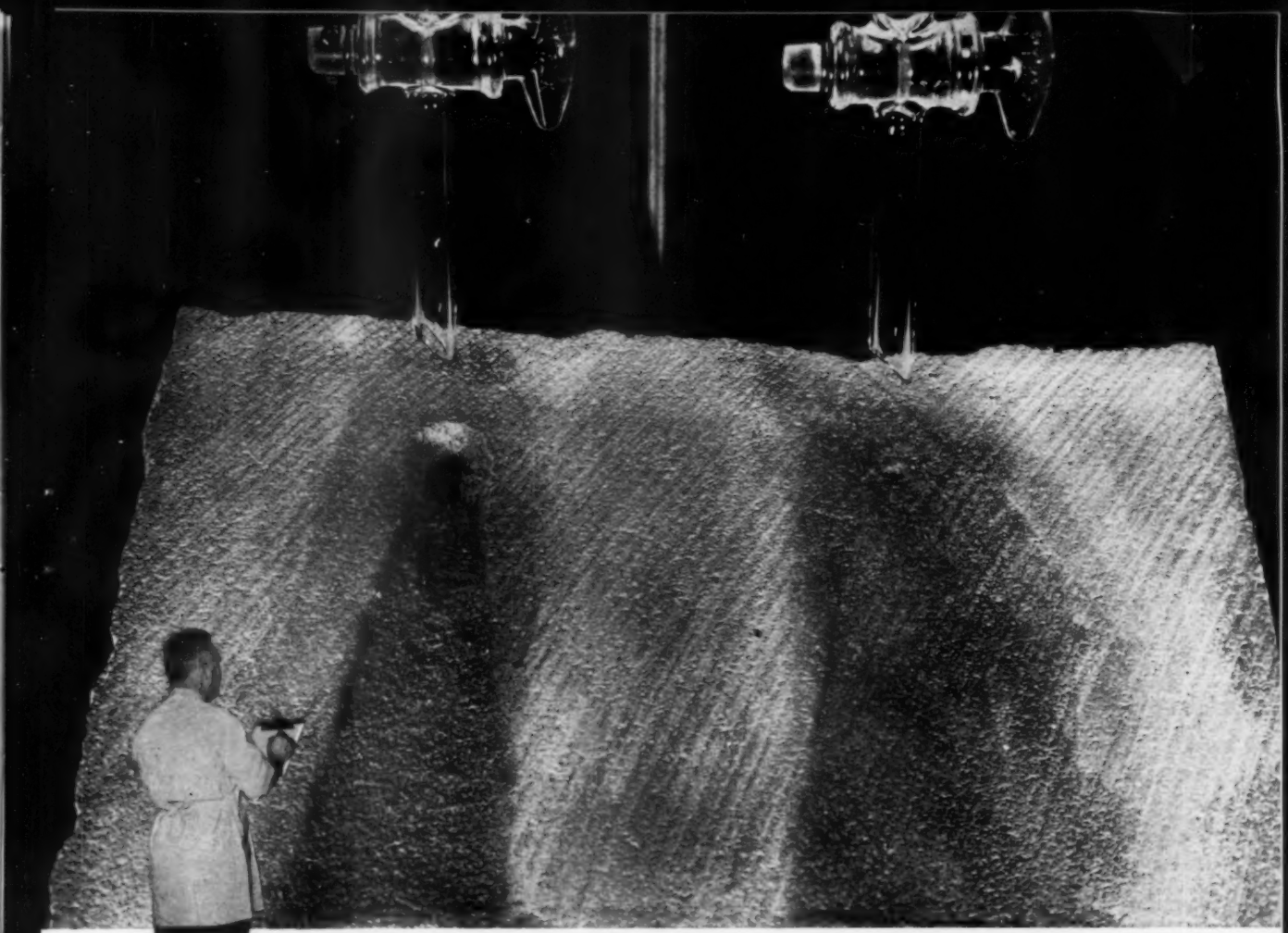
Reiter-Foster Oil Corp. of New York has completed purchase of producing properties of Advance Petroleum Co. of Dallas and Carl J. Westlund. Reiter-Foster paid $1,505,000 in stock and cash for 7,774 gross producing acres in Texas and Oklahoma and 14,787 net undeveloped acres in Texas.

Oil reserves on the property are estimated at 1,700,000 bbl. Gas reserves are estimated at 4,373,700,000 cu. ft. Average monthly production is 8,025 bbl. of oil and 12,660,000 cu. ft. of gas from 58 wells.

Texam Oil Corp. of San Antonio has sold its 50 per cent interest in Adkins Drilling Co. for $40,000 in cash to John J. Adkins, who founded the drilling firm. Adkins also acquired undivided one-half interest in the drilling company's leaseholds in Gonzales County, Texas. Texam acquired its interest in the Adkins company in 1942.

Interstate Oil Compact Commission will hold its 1958 midyear meeting in Salt Lake City and its 1959 annual meeting in Pennsylvania. The Salt Lake City meeting is scheduled for June 23-25 with headquarters in the Hotel Utah. Time and place of the Pennsylvania 1959 annual meeting have not been set, but the meeting will coincide with the Drake well centennial celebration.

The Natural Gasoline Association of America will hold its first Rocky Mountain regional meeting September 25 in Billings, Mont. The 1-day program will feature technical papers on problems of cold-weather, gas-processing operations in the mountain states and Canada. Sour-gas handling and treating and sulfur recovery will be the principal topics.



Reaction rate of Retarded Acid (right) is slower than that of regular acid, allows greater penetration into formation before completely spending.

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U.O.P. Sale Opposed

Referee recommends New York court turn down sale, says terms may not be in public interest on long-range basis

NEW YORK.—Referee Louis M. Loed has turned thumbs down on an order to permit sale of Universal Oil Products Co.

In a recommendation to State Supreme Court Justice Jacob Markowitz, Loeb pointed out that:

... Procedures and terms of the sale are spelled out in the order. Signing of the order would, in effect, approve the specified terms.

... There is no provision granting Guaranty Trust Co. the authority to sell any U.O.P. stock at this time.

... There is no guarantee that the proposed terms of the sale will still be appropriate and will best serve the public welfare at some time in the future.

"It is true that no party is now objecting to the proposed terms of sale," Loeb said, "but in the absence of proof that such terms of sale will be in all respects the most appropriate . . . it is my opinion that they should not be approved at this time."

What it means . . . If Loeb's recommendation is upheld, it will force Guaranty Trust to take an entirely new tack if it hopes to go through with the proposed sale of U.O.P.

Guaranty's original application for permission to sell the stock was made in May 1956. Both American Chemical Society, beneficiary of the trust, and the New York attorney general concurred in the petition.

The attorney general, however, wanted assurance that a "provident sale price" would be obtained. He also found Guaranty's request to "retain 10 per cent of the proceeds" of the sale to be "grossly excessive and unreasonable in amount."

The trust was set up by Shell Oil Co., Standard Oil Co. (Ind.), Standard Oil Co. of California, Standard Oil Co. (N. J.), The Texas Co., and N.V. de Bataafasche Petroleum Mij. under the name of Petroleum Research Fund.

Guaranty, as trustee, felt that as long as the income of the trust was derived solely from Universal securities, it would be difficult to carry out effectively the research projects for which the fund was created. It wanted to remedy the situation by selling U.O.P. stock and investing the proceeds in a diversified portfolio.

See-sawing events . . . In the beginning, vigorous objections to the sale were raised. Then an agreement was reached, and it appeared the court procedure had settled down to being a mere formality. Now, Loeb's recommendation throws cold water on chances of a quick settlement and sale.

The original objections came from 13 independent refiners and the Independent Refiners Association of America on grounds that the sale would result in "direct, immediate, and irreparable damage" to them.

The independents asked to intervene and, despite the opposition of Guaranty and the A.C.S., were granted the right to do so. The two factions came to terms May 17, agreeing that:

... Managing underwriters would be required to secure national distribution among underwriters and dealers.

... No underwriter or dealer would be permitted to sell more than 2 per cent of the voting securities to any one investor.

... Guaranty Trust would approve the contracts between U.O.P. and the intervenors.

The hearing on which Loeb based his findings was held July 11. Loeb is president of the Bar Association of the City of New York and a member of the firm of Lord, Day & Lord. He was appointed referee after William J. O'Shea, his predecessor, died last April.

Import Cases Set Next Week

WASHINGTON.—Standard Oil Co. (Ind.) will be the first to challenge its quota under the new imports-control program when hearings start next week before Navy Capt. M. V. Carson, Jr., administrator.

Only four companies have asked so far to have hearing dates set. All will be heard in a 3-day period. Tidewater Oil Co., Standard Oil Co. (Ohio), and International Refineries, Inc., will follow Indiana Standard in that order.

Indiana Standard and Tidewater are protesting the quotas as set down under the formula last month.

The other two companies, however, complain that their allowables, which are the amounts they plan to import during the last half of this year, make no provision for increases which they plan for the first 6 months of 1958.

The figures . . . International Refineries, with imports of 9,200 bbl. daily last year, was given 10,900 bbl. daily under the formula. But its import program calls for 11,900 bbl. daily for the year ending next June 30.

Ohio Standard, with 1,900 bbl. daily last year and 8,200 bbl. a day planned for the current half-year, submitted no estimate of its 12-month average. It indicated, however, it planned a higher volume than allowed.

Indiana Standard, with 17,800 bbl. daily last year and plans for 49,400 bbl. a day over the last half of this year, was given 29,800 bbl. daily.

Tidewater, with 22,200 bbl. a day last year and plans for 84,600 bbl. through the last half of 1957, was allowed 34,200 bbl.

A number of other companies have filed requests for hearings. At the week end, however, none had asked for specific dates. But officials refused to speculate that perhaps fewer importers than expected will formally ask for higher allowables.

Sun holds out . . . A meeting with Sun Oil Co. executives last week failed to change their position that they could not actively participate in the program because of possible danger of violating the antitrust laws.

Sun agrees that imports are supplanting rather than supplementing domestic supplies, Carson said after the meeting. The company has plans to cut its imports on its own initiative. Thus the objective of the program will be reached, he said.

First of the monthly reports called for under the program are coming in to Washington. About half of the importers have filed their reports for July, but not enough have been received to show any trend in actual imports for the month.

Reports filed with the Texas Railroad Commission, however, show that July imports were well above the formula. Carson is not disturbed. He points out that it will be several months, probably October, before the companies are able to show real cuts.

Discovery Spurs Pecos Play

FORT STOCKTON, Tex.—A big effort to find pre-Permian oil in the deep sediments of Pecos County, West Texas, has paid off with a good Ellenburger discovery 35 miles southeast of here.

Standard Oil Co. of Texas 1 Hokit "2" flowed 740 bbl. of oil daily on its initial drill-stem test at 11,303-11,423 ft. Gas surfaced in 8 minutes. Time was not given on the oil.

The heavy flow was through ¾-in. choke under pressure ranging from 325 to 425 psi. Pressure increased to 4,345 psi. after being shut in for 30 minutes. Operators was making repairs at total depth of 11,454 ft.

The wildcat is about 10 miles northeast of nearest production at Puckett field, where pay is from the Pennsylvanian, Devonian, and Ellenburger—all pre-Permian.

Geologically, the discovery is in the Sheffield channel, a buried feature said to connect the Delaware basin on the west to the Val Verde basin on the east. The channel is an area of deep sedimentation, offering very little subsurface control and poor seismic pictures.

Until just recently, the channel invited only cautious drilling. Wildcats were few and far apart. But, today there are six more wildcats drilling ahead, scheduled below the Permian (see map).

Military Cuts Pinch Refiners

WASHINGTON. — The Defense Department's economy program calling for a cutback in oil purchases is bringing bitter protest from independent refiners.

The plan to jam most of the $115 million to $170 million cut into the last 5 months of this year can be carried out by the Military Petroleum Supply Agency only by taking less on existing contracts.

Refiners claim this will have two results:

. . . **Stocks held by military** will be drawn down to the danger point.

. . . **Refiners will have money** tied up in stored products for which there may be no civilian market.

The impact of the cut should be lessened by spreading it over the remaining 10 months of the fiscal year, Elmer E. Batzell, counsel for the Independent Refiners Association of America, said last week in a letter to Defense Secretary Charles E. Wilson.

Deliveries under present contracts should be continued as far as possible, Batzell said. As much of the saving as can be should be made by cutting back on new contracts.

Contracts usually impose no liability upon the Government for reduced deliveries, Batzell admitted. But "they still are subject to ordinary standards of good faith in their administration."

Lawmakers concerned . . . Congress also has shown interest in the military program.

Sen. Joseph C. O'Mahoney of Wyoming last month called on Wilson to review the policy on oil.

If present stocks are drawn down too deeply, the military later will have to rebuild them, O'Mahoney said. In the meantime it is possible that the cutback policy will make some suppliers unable or unwilling to risk further contracts.

Both O'Mahoney and Batzell charged that the cutback plan nullifies the concessions made to small refiners to induce them to take government contracts.

"If a small refiner gets a contract but receives very reduced orders for deliveries under it, the contract has proved meaningless," Batzell told Wilson.

"As you know, the history of World War II and Korea makes clear the importance in mobilization of the domestic refining industry, and particularly of the independent refiner," Batzell pointed out. "The concerns expressed here are therefore not merely those of the refiners as businessmen dealt with roughly by their Government but more importantly, the concerns of an industry whose mobilization readiness may be seriously handicapped by thoughtless and abrupt changes in peacetime orders by the Government."

Gas Brief Is Filed

Independents say status differs from big firms

DENVER.—Eight independent oil and gas producers' associations have entered a lawsuit testing whether the Supreme Court intended in the Phillips case to place small independent gas producers under Federal Power Commission regulation.

The associations, located in five states, have filed an amicus curiae (friend of the court) brief with the Tenth Circuit Court of Appeals here on behalf of the Saturn Oil & Gas Co., which is challenging the FPC effort at regulation.

The amicus curiae brief contends that the Supreme Court, in holding Phillips Petroleum Co.'s natural-gas operations subject to FPC control, meant that only large integrated companies should be affected and that FPC's regulatory powers should be limited to gas sales made "after production and gathering have ended."

According to the eight associations joining in the suit, a victory for Saturn would be a "victory for thousands of small gas producers far more sweeping than passage of the vetoed Harris-Fulbright bill or the new Harris bill now pending in Congress."

Saturn is a small Kansas company engaged only in gas production. It differs from Phillips, the associations said, because (1) its sales occur at the wellhead, (2) it does not process gas for resale to pipelines, and (3) it does not transport gas across state lines en route to the processing plant.

Associations which jointly filed the brief are Texas Independent Producers and Royalty Owners Association, West Central Texas Oil and Gas Association, North Texas Oil and Gas Association, Texas Panhandle Producers and Royalty Owners Association, Independent Producers and Royalty Owners Association of New Mexico, Kansas Independent Oil and Gas Association, Louisiana Independent Producers and Royalty Owners Association, and Oklahoma Independent Petroleum Association.

Inventories and imports climb as . . .

West Coast Refiners Cut Back

LOS ANGELES.—Petroleum stocks climbed to 118,000,000 bbl. on the West Coast, and at least two refineries have cut back runs "to bring supply and demand into balance."

Both Richfield Oil Corp. and Wilshire Oil Co. of California made 10 per cent cuts at their Wilmington and Norwalk refineries. The total cutback for both companies amounts to about 13,000 bbl. daily.

Total petroleum inventories gained about 14,000,000 bbl. in the past 3½ months, and are nearly 11,000,000 bbl. above inventories for the same period last year.

Commenting on the high inventories, Charles S. Jones, Richfield president, said that "these conditions cannot continue without the most serious effect on every segment of the industry."

One immediate serious effect is the worst service-station price war the area has seen in many years. At the peak of the war in mid-August, regular and premium-grade fuels were retailing at major-company stations for about 6 cents less than normal.

However, the price war was showing signs of ending last week. In Los Angeles, gasoline was still readily available at most major-company stations 1 or 2 cents less than normal.

Some major companies think the gasoline stocks are about 4,000,000 to 5,000,000 bbl. higher than they should be. Gasoline stocks reached a peak this year in April when they hit 30,400,000 bbl.

Since then they've edged down to 25,000,000 bbl. as of August 16. But this is still over 3,000,000 bbl. more than they were a year ago at that time.

Failure of demand to live up to expectations is cited as the chief reason for the gain in gasoline stocks. First-half demand averaged 519,000 bbl. daily, only 3.4 per cent above that for the like period of 1956. This was below the 4 or 5 per cent annual gain recorded in most recent years on the West Coast. Gasoline supply was up 5.7 per cent—to 536,000 bbl. daily.

Imports . . . As inventories climbed, so did imports. Foreign crude has been coming into the West Coast at an increasing rate since the first part of the year. In June, they averaged 275,300 bbl. daily, but the big peak came in July when they averaged 342,000 bbl. daily (see table). This is about 142,000 bbl. more than during the same month last year.

Second-half imports are scheduled to average about 275,000 bbl. daily. This is about 70,000 bbl. higher than the average during the last 6 months of 1956.

Tying in with the high import rate is the big gasoline inventory. Nearly all the foreign crude being imported is high gravity. In comparison with low-gravity California crude, a greater percentage of each barrel of foreign oil thus ends up as gasoline, or light fuel oil.

Crude stocks . . . Crude-oil stocks during the first half of this year showed only a slight gain. For the most part they ran behind those of a year ago.

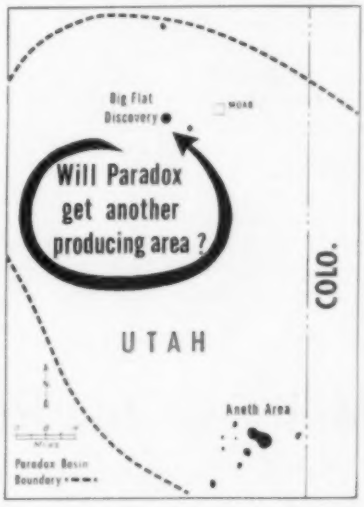
But in July, when imports shot up, crude inventories also took a big climb. They jumped from 32,900,000 bbl. on July 1 to 36,200,000 bbl. August 1.

The West Coast has had higher over-all inventories of petroleum in the past, but then the high levels were brought about primarily by large inventories of residual fuels.

The situation is different now. Residual stocks are running only about 3,000,000 bbl. above those of a year ago. And during the last two winter seasons, inventories were so low that refiners were barely able to get through the heating season.

A Look at the West Coast

	Production (per day)	Crude imports (per day)	Petroleum stocks	Daily refinery runs
			—Thousand bbl.—	
1956—				
January	972,000	134,200	102,600	1,124
February	970,000	134,400	100,600	1,112
March	967,000	173,600	99,900	1,109
April	965,000	140,400	101,000	1,056
May	965,000	187,300	103,400	1,114
June	962,000	145,900	103,600	1,081
July	962,200	200,400	107,000	1,143
August	959,300	203,000	107,900	1,106
September	955,200	232,400	110,800	1,181
October	952,100	218,200	111,700	1,103
November	951,000	180,600	109,800	1,170
December	944,000	193,400	108,400	1,154
1957—				
January	939,000	209,400	105,000	1,138
February	940,000	171,000	101,900	1,133
March	930,000	208,500	103,000	1,144
April	929,300	238,000	103,900	1,149
May	927,200	285,000	109,300	1,204
June	930,500	275,300	113,800	1,130
July	924,000	342,000	121,800	1,139



Utah Wildcat Hits

Pure strike is 90 miles north of the Aneth area

MOAB, Utah.—Exploratory interest in the Paradox basin has shifted 90 miles north of the Four Corners' Aneth trend to a new discovery well in Grand County, Utah.

Pure Oil Co. reports an oil flow of 319 bbl. of 43.3°-gravity oil in 24 hours on tests of its 1 Big Flat Unit.

Pure's wildcat produced from the Mississippian lime at 7,694-7,728 ft. Location is 14 miles west of Moab on a 19,500-acre unit shared by Pure and Glen Ruby Associates. Pure also has leases on 6,500 adjacent acres.

An earlier wildcat drilled on the Big Flat structure by another company produced oil, but not commercially, and was abandoned.

The Mississippian discovery points up the tremendous untouched potential of Mississippian rocks in the northern part of the Paradox basin. Pure's well is on the mobile flank

of the basin against the Uncompahgre Uplift.

The closest current Mississippian production is in Wyoming. There is none of consequence in Utah, Colorado, or the Paradox basin.

Jal Pipeline to Begin

Contracts let for second Four Corners crude line

HOUSTON.—Construction of the second crude-oil pipeline out of the Four Corners area is scheduled to start this week.

Texas-New Mexico Pipe Line Co. announced that contracts have been awarded for the 512-mile system between the Aneth area of Utah and Jal, N. M.

Four Way Co., Inc., Aztec, N. M., was awarded contract for a 150-mile section extending southeast from Aneth field. Panama, Inc., Houston, will lay the other two sections consisting of 362 miles of pipe.

The Texas Co., part owner of the system, said clearing and grading of right-of-way will begin within a week. Actual laying of pipe is expected to begin about October 15.

Partners in Texas-New Mexico Pipe Line, besides Texaco, include Sinclair Pipe Line Co., Tidewater Oil Co., and Empire Gas & Fuel Co.

The 16-in. line, running southeast across New Mexico, can feed 50,000 bbl. daily of crude to lines extending from the Jal area to Gulf Coast and Mid-Continent refineries.

Texas-New Mexico will compete with Four Corners Pipe Line Co. for crude oil from new fields near the common corner of New Mexico, Arizona, Utah, and Colorado.

Four Corners Pipe Line, which has about a 3-month head start in construction work, is laying a 16-in., 70,000-bbl. line to move the crude to Los Angeles refineries.

Vermont Test Drills Ahead

ST. ALBANS, Vt.—Vermont's first wildcat was back drilling last week below 2,000 ft. after a 3-week shutdown to seal off flowing water zones.

A heavy cable-tool rig operated by John Shaw, Kane, Pa., drilling contractor, spudded the Granite State's first test early in April (OGJ, April 15, p. 97).

The Isadore Yandow No. 1 has had a number of gas shows below 800 ft., but none that are regarded as commercial. Plans are to carry the test to 5,000 ft.

The well is being drilled by Peter Henderson Oil Co., New York.

Pipeline briefs

Transcontinental Gas Pipe Line Corp. plans to extend its transmission system to the New Orleans area to gather gas recently purchased in seven Louisiana fields.

An application filed with the Federal Power Commission seeks authority to construct 87 miles of 24-in. laterals, plus smaller gathering lines to connect the fields with Transco's main pipeline. Cost of the project is estimated at slightly more than $14,000,000.

New purchase contracts provide for a minimum take of 68,000,000 cu. ft. of gas daily during the first year. However, the proposed supply system would have a capacity of 222,000,000 cu. ft. daily.

Trans-Canada Pipe Lines, Ltd., is taking gas from Alberta's Bindloss field as testing and line filling proceeds on the 574-mile, 34-in. section from Alberta to Winnipeg. The line has been tested with gas and filled as various sections were completed on the first stage of the project. Gas will soon be flowing into Winnipeg, marking the first operation of the 2,250-mile line that is expected to reach Montreal by late next year.

Contractors which have just completed 34-in. sections, or are winding them up, are Majestic Contractors, Ltd., Canadian Bechtel, Ltd., Universal Pipe Line, Ltd., Dutton-Williams Brothers, Ltd., and Price-Poole of Canada, Ltd.

Inland Natural Gas Co., Ltd., which will transport gas from the new Westcoast Transmission Co., Ltd., will complete its system through southern British Columbia next week, a month ahead of schedule. The $15-million project, which will serve 37 cities, has 304 miles of mostly 10 and 12-in. main lines from Savona to Nelson, B. C. Capacity is 50,000,000 cu. ft. per day. Dutton-Williams Brothers, Ltd., built the line.

Dutton-Williams is also completing three of the four original 18,000-hp. compressor stations on the Westcoast 30-in. main line from Peace River to the British Columbia border at Sumas, Wash. Stearns-Roger Manufacturing Co. is building the other station. The huge engine-driven centrifugal stations cost $5 million each. The line itself is complete.

Tennessee Gas Transmission Co. is winding up a 33-mile project of 6, 8, and 10-in. lateral lines picking up gas in the vicinity of Southwest Pass below New Orleans. Houston Contracting Co. handled the job.

El Paso Natural Gas Products Co. will start work next week on a 250-mile, 6-in. products line contracted to McVean & Barlow, Inc., Odessa. The line will transport high-octane motor fuels from the company's new 6,500-bbl. daily Odessa refinery, due to go on stream next year, to El Paso for distribution in West Texas, New Mexico, and Arizona. The contractor has 5 months to complete the job, which will be supervised by E. J. Miller, spread superintendent.

Gulf Interstate Gas Co. has received permanent authority from the FPC to operate $8 million in new facilities increasing capacity from 401,000,000 to 448,000,000 cu. ft. daily. Gulf Interstate could deliver 473,000,000 cu. ft. daily under overload conditions. The expansion involved 19,500 hp. in compression and lines connecting new supplies of gas in South Louisiana. Addition of 69,000 hp. in another expansion to cost $24,500,000 will raise capacity to 575,000,000 cu. ft. daily this winter.

Also for Pipeliners . . .

Among probes asked by Senator O'Mahoney is one into a monopoly of domestic pipelines (p. 86) . . . Shell will supply half the Alberta gas for new pipeline to San Francisco (p. 92) . . . Suit filed to determine status of small independent gas producers under Phillips decision (p. 99) . . . Work starts this week on second crude line out of Four Corners area (p. 101) . . . Pauley steps up plans for Mexico-to-Cuba gas pipeline (p. 104) . . . Right-of-way is being purchased for a 230-mile, 28-in. crude pipeline from Wilhelmshaven to Cologne in West Germany.

PLUS THESE TECHNICAL FEATURES: Gager's slide rule: A simple device to compute crude-oil lease-tank runs and reduce gathering losses (p. 142) . . . and Pipeline Patrol's construction report (p. 167).

Mattei Welcome in Iran

Italian wins approval from Iranian senate on exploration deal, now seeks concessions in Syria, Jordan, and Yemen

ITALY'S TIRELESS and canny Enrico Mattei secured a foothold last week in his relentless climb toward a stake in Middle East oil, and then struck out on three more fronts which might lead him to the same goal.

The Iranian Senate approved Mattei's deal with National Iranian Oil Co. for oil exploration in Iran. All that remains is the Shah's signature and that probably is only a formality. The Majlis (lower assembly) approved the agreement early last month (OGJ, Aug. 12, p. 93).

At the same time, the energetic head man of Ente Nazionale Idrocarburi, Italy's government oil agency, revealed that he is asking for oil rights in Syria, Jordan, and Yemen. None of these can be regarded in the same class as Iran, but the fact he wants them illustrates Mattei's determination to branch out abroad.

There have been no official announcements of the new applications, but Italian sources say they have been made. Count Carafa d'Andria, a man active in Italian government oil circles even longer than Mattei, has visited all three countries trying to swing the deals. Count d'Andria's contacts in Yemen date back to the early 30's when he first became active in Italian oil under Mussolini.

Here is what E.N.I. wants:

. . . **98,000 acres** of exploratory licenses in the Aleppo district of Syria, just south of the Gaziantep area of Turkey where American companies are now drilling.

. . . **61,750 acres** of exploration concessions in the troubled Aqaba Gulf region of Jordan.

. . . **49,400 acres** to look for oil in the San'a district in Yemen's interior. San'a is the capital of a feudal kingdom which is carrying on a sporadic raiding war with the British over disputed territory of British-protected Aden.

E.N.I. is offering all three countries the same package which sold the Iranians—a joint company which splits the profits, if any.

The Iranian deal calls for Mattei to put up all the exploration money, which he hopes to get from private Italian sources, and keep 25 per cent of profits. Fifty per cent of the profits would go to National Iranian Oil Co. and the remaining 25 per cent to the Iranian Government.

Record in Egypt . . . So far, Mattei's foreign ventures show a great deal more promise than his efforts to develop a domestic Italian oil industry.

His agency owns control of International Egyptian Oil Co., in which Petrofina and Swiss banking interests also participate. International Egyptian in turn has 51 per cent of the newly formed Oriental Oil Co. The remaining 49 per cent is owned by the Egyptian Government and Egyptian Oil Cooperative. Oriental is developing Belayim, Feiran, Abu Rudeis, and Ekma fields on the west side of the Sinai Peninsula.

The Egyptian operation, established and once conducted by a minority American interest, is now under direct Italian control. Italians trained in the Po Valley are running the show. They claim to have completed 20 wells at Belayim, the biggest and most promising of the fields. Abu Rudeis and Ekma are new discoveries. The Abu Rudeis discovery tested 1,400 bbl. daily from 9,200 ft.

Belayim, Abu Rudeis, and Feiran are all large structures that extend out under the Gulf of Suez. Several slant-hole wells have been drilled to underwater bottoms, but platform drilling is next on the program.

E.N.I. has apparently impressed the Egyptians since they took over the operation. Reports from the Mediterranean indicate that the Italians plan to lift 1,000,000 bbl. of this crude. Presumably it will be shipped to Italy for refining. This may help quiet internal criticism of Mattei's penchant for foreign operations because at least half of Italy's $800-million annual trade deficit is in crude-oil imports.

The Egyptians, themselves crude-short and with more than 70,000 bbl. daily in refining capacity, are getting crude from their Moslem ally, Saudi Arabia.

In northern Somalia, formerly an Italian mandate, E.N.I.'s subsidiary AGIP Mineraria has not done so well. The company moved a rig into the region more than a year ago, but at last reports it was shut down because of mechanical troubles after drilling only to about 2,000 ft.

Flops at home . . . At home in Italy, Mattei has little to boast about. His failure to develop a thriving Italian oil industry from the Po Valley monopoly given him by the government has handed his critics most of their ammunition.

In a recent interview printed in the Rome daily, "Il Tempo," Mattei boasted that his Iranian deal will let him influence world oil prices. This sounds good to Italian socialists who have to pay for the oil the country uses now, but Italian business circles are openly skeptical. They point out that an exploration concession is a lot different from an oil field.

E.N.I. now controls 17 million acres of Italy's oil exploratory area. This is 68.5 per cent of the total land under oil lease in the country.

E.N.I. now has applications with the government for another 5,600,000 acres which are regarded as certain to be granted.

During the first 6 months of this year, E.N.I.'s production record in Italy looks better than the same period last year, but is woefully short of the country's needs.

E.N.I.'s fields, all in the Po Valley, produced only 2,230 bbl. of crude and liquid hydrocarbons the first half of this year. Natural-gas production, also in the Po Valley, averaged 455,000 M.c.f. daily.

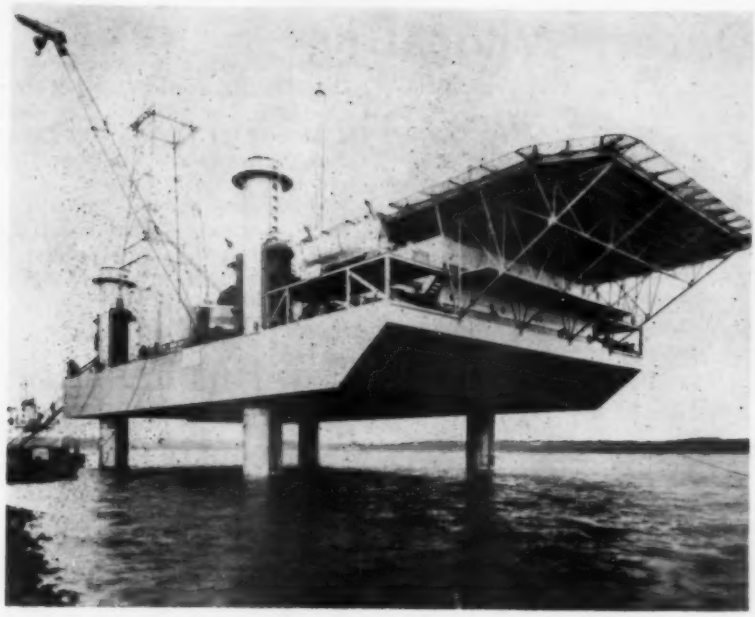
The world's oil companies still don't know whether Mattei's current moves outside Italy are really aimed at finding production, or if they are merely propaganda moves in his efforts to acquire an oil supply. He once tried unsuccessfully to get an interest in the international consortium which operates Iran's productive fields. Bitter at private oil industry since his failure, he has been quoted as saying, "They've got to make room for me."

Sardinia Grants Concession

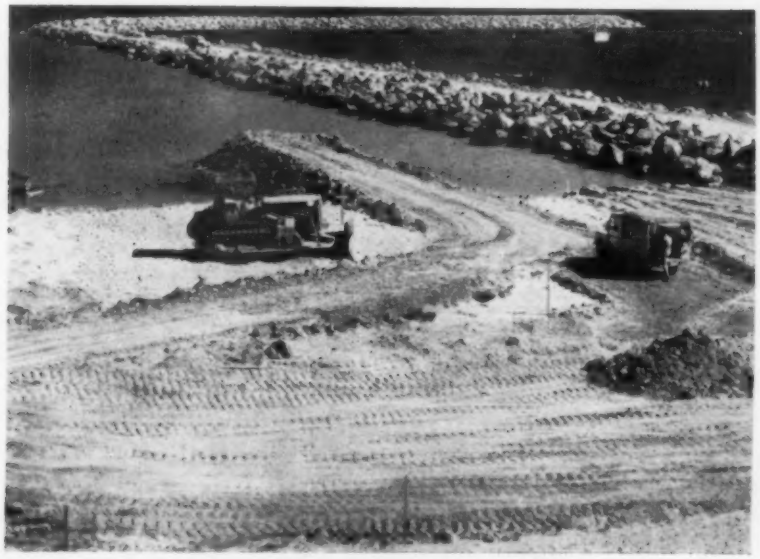
A WEST GERMAN FIRM has acquired a majority interest in a 3,500-sq. mile concession over western Sardinia.

Wintershall A.G. will operate jointly with the government of the Mediterranean island through Azioni Idrocarburi Sardegna (SAIS). The semi-autonomous government has its own oil law, which is more favorable to foreign companies than the new law in effect on the Italian mainland.

SAIS will begin with geological mapping, to be followed by geophysical work, late next year or early in 1959.



Europe's first mobile drilling barge . . .



. . . will work in Persian Gulf after a . . .

Strange 6,800-Mile Sea Trip

SOMEWHERE between Audorf, Germany, and Gibralter an ocean-going tug is lumbering along towing one of the strangest burdens that ever made a 6,800-mile ocean trip.

The tug is on the first leg of its 2½-month voyage to deliver a 4,200-ton mobile drilling barge from the Kiel Canal shipyard where it was built to the Persian Gulf where it will drill for oil.

The barge will be the first of its type ever used outside the U.S.

The big barge will drill for Abu Dhabi Marine Areas, Ltd., which holds a concession on 12,000-sq. miles of underwater lands off the Trucial Coast of Arabia. The company is jointly owned by British Petroleum Co., Ltd., and Cie. Francaise de Petroles.

The barge hopes to make an average speed of 4 knots on its trip, and will drill its first well in 50 ft. of water sometime early next year. The first test will be 20 miles off the little island of Das in the Persian Gulf where the company is building a permanent base for its drilling activities.

The equipment is British and French-owned. It was designed by DeLong Corp., New York, and was built in Germany by Gutehoffnungehutte Sterkrade Aktiengesellschaft.

The equipment . . . The barge itself is 200 by 100 ft. and 15 ft. deep.

It has four retractable caisson legs 10 ft. in diameter and 165 ft. long. The legs are elevated and lowered by eight DeLong hydraulic jacks and will hold the barge 40 ft. above water level when in drilling position.

Already installed on the unit is a National 130 rig with four 400 hp. Paxman engines. The 140-ft. derrick is mounted on a 30 by 30 ft. base and can lift 550 tons.

In addition to three large hoppers for 140 tons of cement, 125 tons of barites, and 80 tons of bentonite, the barge has storage facilities for 500 tons of fuel oil, 170 tons of potable water, 900 tons of drilling water, 140 tons of salt water, and 400 tons of mixed mud.

It will carry its own Halliburton cementing unit and a Schlumberger logging unit.

The unit has air-conditioned living quarters for 50 and a flash evaporator which will make 700 gal. of fresh water an hour at top operating capacity. It is equipped with a Weserhutte mobile crane which lifts up to 30 tons and a helicopter deck.

Ecuador Test Gets Show

CALIFORNIA ECUADOR Petroleum Co., wholly owned subsidiary of Standard Oil Co. of California, is stepping up activities. The company has a promising wildcat in an early concession in Ecuador and now has added a large offshore concession to its holdings.

Reports in New York say California Ecuador has encountered important oil and gas shows below 2,000 ft. in its 1 Santo Domingo. The 10,000-ft. wildcat was located on the west flank of the Progreso basin after 2 years of geological and geophysical work.

About 10 miles west of the wildcat West Pacific Petroleum Co., subsidiary of Israel Mediterranean Petroleum, Inc., and Pan-Israel Oil Co., Inc., has 123,000 acres under concession in Engunga Platform area.

California Ecuador also recently was awarded an offshore concession of 649,610 acres. Seismic crews already are working in the area. The new grant is in addition to an original grant of 3,628,818 acres which also included some offshore acreage in the Guayas River estuary.

Aramco Spuds Desert Wildcat

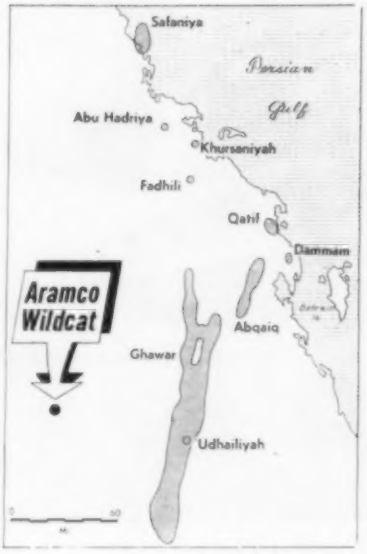
ARABIAN AMERICAN OIL CO. has moved eastward from its flush producing fields in Saudi Arabia for a deep wildcat test of the shifting-sand area of Dahana.

The new deep test was spudded at Khurais about 75 miles to the west of 'Udhailiyah on the mammoth Ghawar producing trend. It is being drilled by the same heavy rig which Aramco used for its 14,875-ft. dry hole in the Rub al-Khali, the desolate sandy area of the southern Arabian Peninsula which the natives call the "Empty Quarter." The Rub al-Khali test is unquestionably the deepest hole ever drilled in the Middle East.

Aramco estimates that the new wildcat will cost a million dollars and will take 6 months to complete.

The Dahana is regarded by Aramco geologists as one of the six physiographic provinces of Saudi Arabia. It is a sand strip 15 to 45 miles wide which stretches north and then westward for 900 miles from Rub al-Khali.

The region lies along the east edge of the long series of west facing escarpments of Mesozoic outcrops which separate the Central and the Summan plateaus of Saudi Arabia. It is marked by wide bands of shifting sands in the southern region where the Khurais test is being drilled.



Aramco plans to penetrate and test the equivalent of all the oil-bearing formations in the Al Hasa, or coastal province, of the country.

Mexico-Cuba gas line studied as . . .

Pauley Shuffles Latin Holdings

A CUBAN MARKET for Mexican natural-gas may be a step closer as the result of the formation of two new companies last week.

. . . Cuban Gas Transmission Co. was organized in Havana to carry out a grandiose plan by Edwin W. Pauley to build an underwater natural-gas line from southeastern Mexico to Cuba.

Pauley, a Los Angeles independent operator, is active in Mexico on a contract-drilling basis for the Mexican Government. The new Cuban company has initial capital of $5 million.

. . . Pauley Pan American Petroleum Co. was formed to handle all Pauley's holdings in the Western Hemisphere outside the U. S. Pauley is president and principal stockholder with Blyth & Co., investment bankers.

Pauley has three important contracts with Petroleos Mexicanos. These contracts have been transferred from himself as an individual to his new company. One covers oil and gas structures in northeastern Mexico, and the other two contracts are for southeastern Mexico.

Pauley helped develop gas fields in northeastern Mexico which are feeding Texas Eastern Transmission Corp.'s new pipeline from McAllen to Beaumont, Tex. (OGJ, Aug. 26, p. 69).

Southeastern Mexico . . . Pauley's two contracts for southeastern Mexico have already resulted in a large gas supply which would make a Cuban market attractive. The contracts include production in the Rabon Grande and Tortuguero oil fields in the State of Tabasco, and the Xicalango gas fields in the State of Campeche.

The Rabon Grande structure is both on and offshore. The on-shore portion has been producing for the past 5 years. A program is being planned to develop the offshore portion by using drilling barges.

Pauley said the two contracts allow the company "to discover five additional tidelands producing structures off the states of Veracruz, Tabasco, and Campeche, and four additional upland structures in these states."

As for the proposed pipeline from Mexico to Cuba, preliminary surveys are already under way (OGJ, Aug. 26, p. 88).

The line would go overland from Campeche to the eastern coast of Mexico. Then it would cross the Gulf of Mexico for 120 miles to Cuba's shore. From there it would go overland again to Havana.

American & Foreign Power Co., which generates electric power for Cuba, is interested in the project, if engineering studies prove such a project is feasible.

Test Hits in Peru

Stepout in Amazon basin tested at 270 bbl. daily

CIA. PERUANA DE PETROLEO "El Oriente," S.A., has completed the first stepout from its discovery in Peru's Amazon basin.

The 2 Maquia flowed at the rate of 270 bbl. daily through a 1/6-in. choke. Output came from a slightly greater depth than the discovery, which flowed from 2,150 ft.

Total thickness of the reservoir rock is 215 ft. of Upper Cretaceous sandstone. But as in the case of the discovery, the stepout found only 16 to 25 ft. of oil-impregnated core.

The second test was drilled 1,500 ft. southeast of the 1 Maquia, located near Contanama on the west bank of the Ucayali River.

The West German operators on the 176,000-acre concession plan further tests on the structure to determine whether the field is commercial.

The company is controlled by the Guildermeisters, a local Peruvian family. Three West German firms having 50 per cent operating interest are Gewerskchaft Elwerath, Wintershall A.G., and Deutsche Erdoel A. G.

Burma Wildcat Spudded

BURMAH OIL CO. (1954), LTD., has started the first wildcat undertaken in Burma since before World War II.

The company is drilling a shallow well at Ondwe in Central Burma. Its objective is a known gas horizon. Gas from this section will be used as fuel for a deep test on the same structure.

The company also is studying the results of a year-long seismic survey in the Irrawaddy Delta. It expects to pick a site for the first deep test in the area in the near future.

Unsettled political conditions delayed exploration work for several years after the war. The Burmese Army still is relied on to maintain security in the vicinity of Ondwe.

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Aquitaine fans fresh interest:

French Basin Yields Strike

DESPITE THEIR HOPES for North Africa, the French are not forgetting a bird in hand is worth two in the Sahara sagebrush.

The French bird in hand is the Aquitaine basin in southwestern France. The discovery of 24,000-bbl.-daily Parentis field and of Lacq gas field, with 5-trillion cubic feet of reserves, are well-known highlights of European exploration in recent years.

Late last month, a French company teased oil from a fresh part of Aquitaine. Whatever the ultimate worth of the well, the wildcat undoubtedly will stir already-intense interest in the area.

Ste. Nationale des Petroles d'Aquitaine brought in the well 22 miles northeast of its Lacq gas field. Six barrels of medium-heavy crude and 500 cu. ft. of gas were recovered in a 2½-hour test from 4,460 ft.

Last year, S.N.P.A.'s drilling program included six deep tests drilled roughly in a circle north and east of Lacq. These were the Bastennes-Gaujacq, 3 Audignon, Monte-de-Marsa, Lussagnet, Risc'e, and Garlin wells.

The new find is approximately in the middle of the ring formed by these wildcats. It also may be oil from a separate sector of the basin.

Aquitaine basin . . . Exploration work has indicated two separate Lower Cretaceous zones in Aquitaine. The southern zone has Lacq field. The northwestern zone contains Parentis, which is 68 miles northwest of Lacq.

In the northeast, dividing the Lower Cretaceous zones, Upper Cretaceous lies directly on Jurassic, or on a formation known as l'Albo-Aptien which intrudes on the Jurassic.

Wildcat drilling in these areas is going on at the rate of better than two dozen wells per year. S.N.P.A. itself has eight heavy, one medium, and three light rigs. Some of this equipment, however, is used on Lacq development and on exploration in other areas of France.

Esso-R.E.P.'s exploration has turned up three of the four small fields which produce in the basin in addition to Parentis. These are Mothes, Lugos, and Lucats, all within 15 miles of Parentis. The fourth field is Lacq, which has small crude production above the gas horizon.

Mobil Repga is a newcomer to the area. It was one of three companies which snapped up permits on most of the acreage around Bordeaux, given up by Esso last year under terms of its agreement with the government. The total area relinquished amounted to nearly 2,200,000 acres, or half of Esso's initial concession.

Mobil began surface work on its acreage this spring.

Most of the rest of Esso's former acreage was awarded to two local companies, Cie. d'Exploration Petroliere (C.E.P.), and Regie Antonome des Petroles (R.A.P.).

Other companies with acreage in Aquitaine include Cie. Francaise des Petroles (Gascongne), Cie. des Petroles de Guyenne, and Ste. des Petroles de la Garonne.

With 440,000-bbl. daily goal:

Big German Crude Line Set

NORTH-WEST Oil Pipeline Co. is wrapping up the right-of-way for its 230-mile, 28-in. crude pipeline from Wilhelmshaven to Cologne. Work is scheduled to start early next year.

The line will open in November 1958 with an initial capacity of 112,000 bbl. daily. Throughput will be stepped up later, and by 1975 the line will be able to deliver 440,000 bbl. daily from the North Sea port to the industrial Ruhr area of West Germany.

North-West Oil, owned by six refining companies, also will build a T-shaped tanker-unloading terminal at Wilhelmshaven. The pier will extend 2,500 ft. into the Jade River and will be able to handle six 100,000-ton tankers at the same time.

The tank farm at the terminal will have an initial storage capacity of 3,150,000 bbl. Tankage for an additional 2,500,000 bbl. will be built later. Eventually, the terminal may handle as many as 700 supertankers per year.

Total cost of the project will be $47,500,000. This will include $2,900,000 to $3,600,000 for the unloading terminal and $12,000,000 for the tank farm.

Two local firms will supply 95 per cent of the pipe for the line—Phoenix-Rheinrohr and Mannesmann. There will be two pumping stations when the line opens. Two more will be built later.

Ruhr refining expands . . . Purpose of the line is to bring crude directly to a major consumption center for refining.

Esso A.G. has a 68,000-bbl. plant under way at Cologne. It has nearly a half interest in the pipeline company.

A British Petroleum Co., Ltd., subsidiary, which has less than a quarter interest in the line, will start work on an 80,000-bbl. plant in the area this year. B.P. also will build a reshipment terminal on the Rhine River.

Besides Esso and B.P., participants in the pipeline are four locally owned firms: Ruhrbau - Mineralolraffinerie, Ruhr-Chemie, Scholven-Chemie, and Union Rheinische (OGJ, Nov. 19, 1956, p. 152).

Stanvac Abandons Wildcat

STANDARD-VACUUM OIL CO. has abandoned its first test on its 10,000-sq.-mile concession in India's Bengal basin. The well, 1 Burdwan, was bottomed at 8,921 ft. Stanvac is now setting up the rig 35 miles northwest for another wildcat, 1 Galsi.

The Indian Government has added a third zone where it plans to search for oil on its own. It is at Cambay, on India's West Coast north of Bombay. Other areas reserved by the Government are in Punjab, where a Romanian crew is drilling a well at Jawalamukhi, and in Assam near acreage held by Assam Oil Co., Ltd.

Maracaibo Set for Terminal

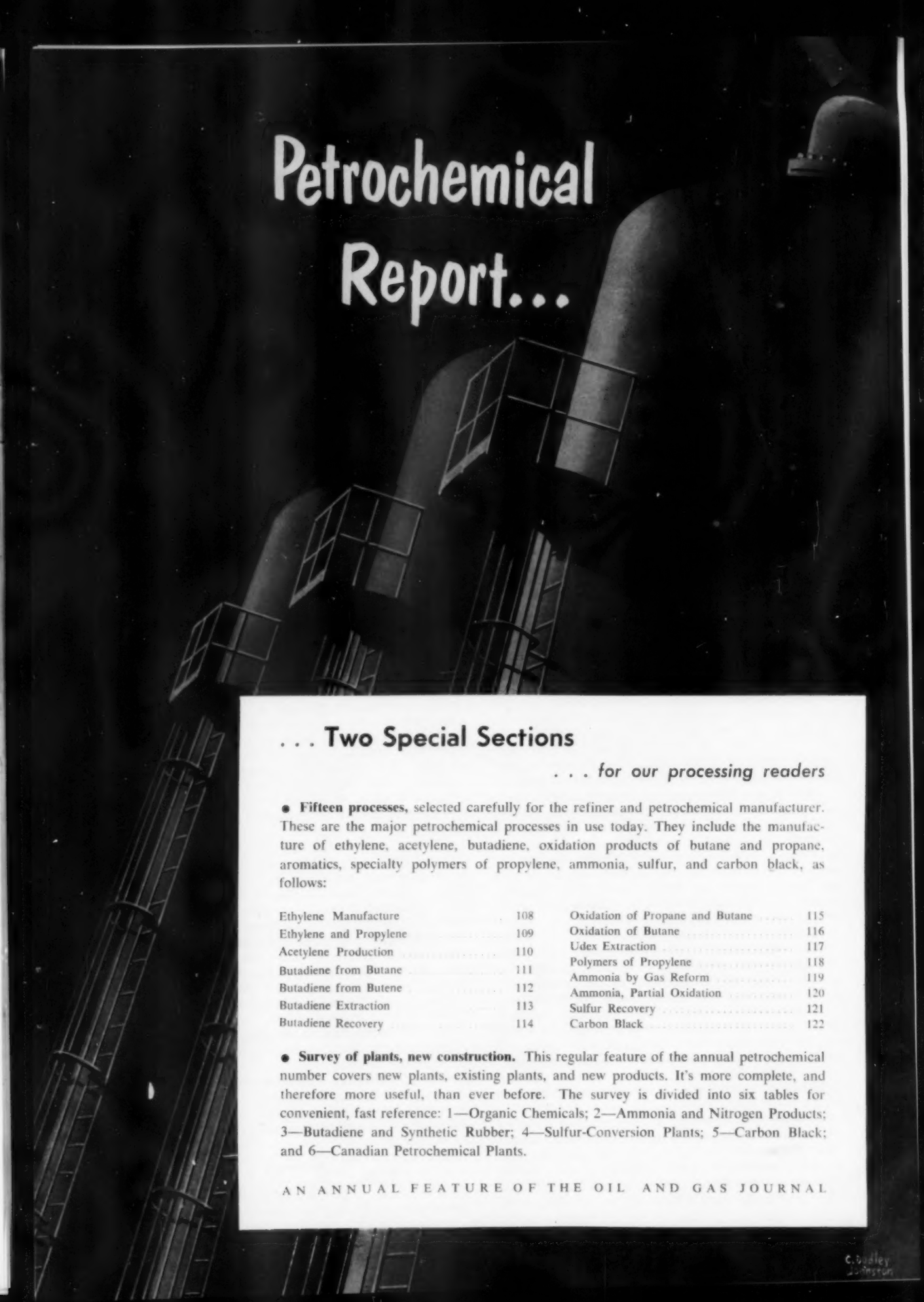
CIA. SHELL DE VENEZUELA will build an $84,000,000 deep-water tanker terminal on the neck of Lake Maracaibo.

The shipping and tankage facilities will be completed by the end of 1957 at Punta Gorda on the eastern side of the lake entrance.

The terminal will have an initial loading capacity of 700,000 bbl. daily. It will take crude from Shell's lake and shore production.

Shell currently produces about 900,000 bbl. daily in the area. The crude is transported largely by underwater lines to tank farms at Bachaquero, Cabimas, and Palmarejo.

A 160-mile, 30-in. pipeline, known as Lightline, carries light crude from Palmarejo to the 203,000-bbl. refinery at Cardon. There also is an extension to the Mene Grande terminal at Las Piedras.



. . . Two Special Sections

. . . for our processing readers

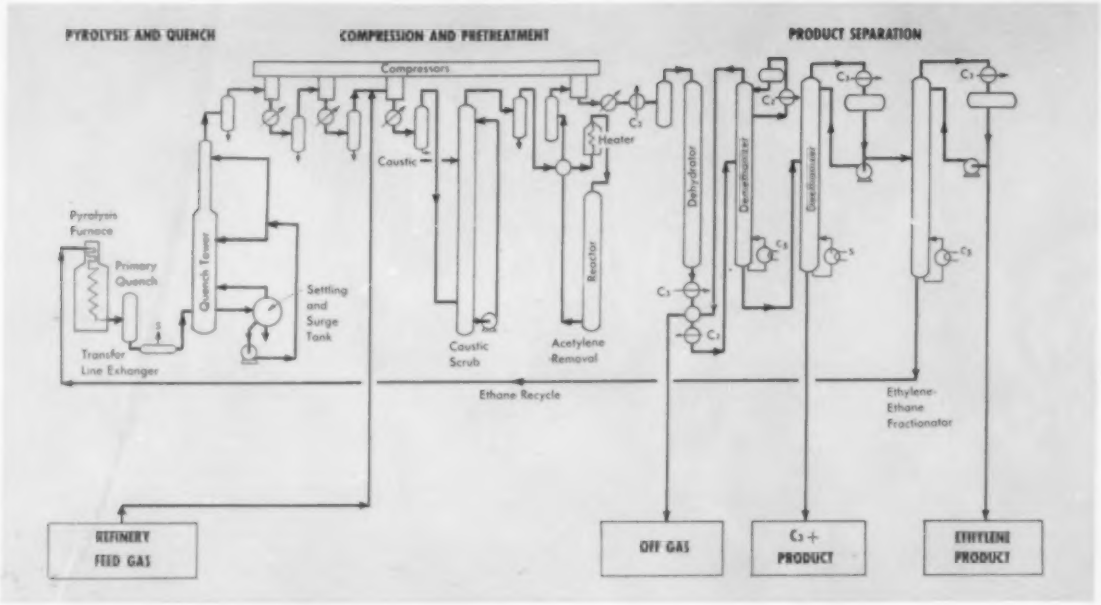
● **Fifteen processes,** selected carefully for the refiner and petrochemical manufacturer. These are the major petrochemical processes in use today. They include the manufacture of ethylene, acetylene, butadiene, oxidation products of butane and propane, aromatics, specialty polymers of propylene, ammonia, sulfur, and carbon black, as follows:

Ethylene Manufacture	108	Oxidation of Propane and Butane	115
Ethylene and Propylene	109	Oxidation of Butane	116
Acetylene Production	110	Udex Extraction	117
Butadiene from Butane	111	Polymers of Propylene	118
Butadiene from Butene	112	Ammonia by Gas Reform	119
Butadiene Extraction	113	Ammonia, Partial Oxidation	120
Butadiene Recovery	114	Sulfur Recovery	121
		Carbon Black	122

● **Survey of plants, new construction.** This regular feature of the annual petrochemical number covers new plants, existing plants, and new products. It's more complete, and therefore more useful, than ever before. The survey is divided into six tables for convenient, fast reference: 1—Organic Chemicals; 2—Ammonia and Nitrogen Products; 3—Butadiene and Synthetic Rubber; 4—Sulfur-Conversion Plants; 5—Carbon Black; and 6—Canadian Petrochemical Plants.

AN ANNUAL FEATURE OF THE OIL AND GAS JOURNAL

C. Dudley Johnston



Ethylene Manufacture

ETHYLENE may be manufactured from various hydrocarbon raw materials including: (1) byproduct refinery gas and by pyrolysis from (2) ethane, propane, butane, and commercial L.P.G., (3) natural gasoline and light refinery fractions, and (4) heavier distillate fractions from crude oil. The process scheme shown is for refinery gas as feed stock. High-purity ethylene is the primary product. A C_3-plus liquid fraction, which may be further fractionated, is a byproduct. The residue gas consists essentially of hydrogen and methane.

Recovery and separation of ethylene from mixtures of hydrocarbons may be accomplished by liquefaction and fractionation at low temperatures. Other possible methods are absorption or adsorption. A combination of absorption and low temperature fractionation also may be used. The recovery method selected depends on the composition of the charge to the separation section and the quantity of inerts. The method shown here is low temperature fractionation.

Process description . . . The refinery feed gas together with pyrolysis vapors is compressed to the demethanizer pressure. This varies according to the concentration of H_2 and CH_4 and the desired ethylene recovery. The compressed gases are cooled. A caustic wash is employed to remove acidic components, CO_2 and H_2S. A dual caustic circulation arrangement is shown with fresh caustic flowing down over the upper trays. Acetylene is removed by catalytic hydrogenation. Acetylene is usually limited in today's ethylene processing to a 25 p.p.m. or less.

Another important step is dehydration of the compressed gases before going to the low temperature separation. The demethanizer is the start of the low temperature fractionation system. Reflux is produced by ethylene refrigeration. Hydrogen and methane are taken overhead. The bottoms go to the deethanizer where ethylene and ethane are taken overhead and propylene and heavier come off as bottoms product. The latter may be further processed in a depropanizer where a propane-propylene cut can be separated from heavier components. Ethane is separated from the ethylene product and is recycled to the pyrolysis section.

Most widely used equipment for cracking is a direct-fired tubular heater with cracking coil arranged to obtain desirable conversion temperatures and a heat-intensity pattern that gives a continuously rising temperature gradient to sustain conversion; the object is to obtain maximum ethylene yield but minimum coke formation.

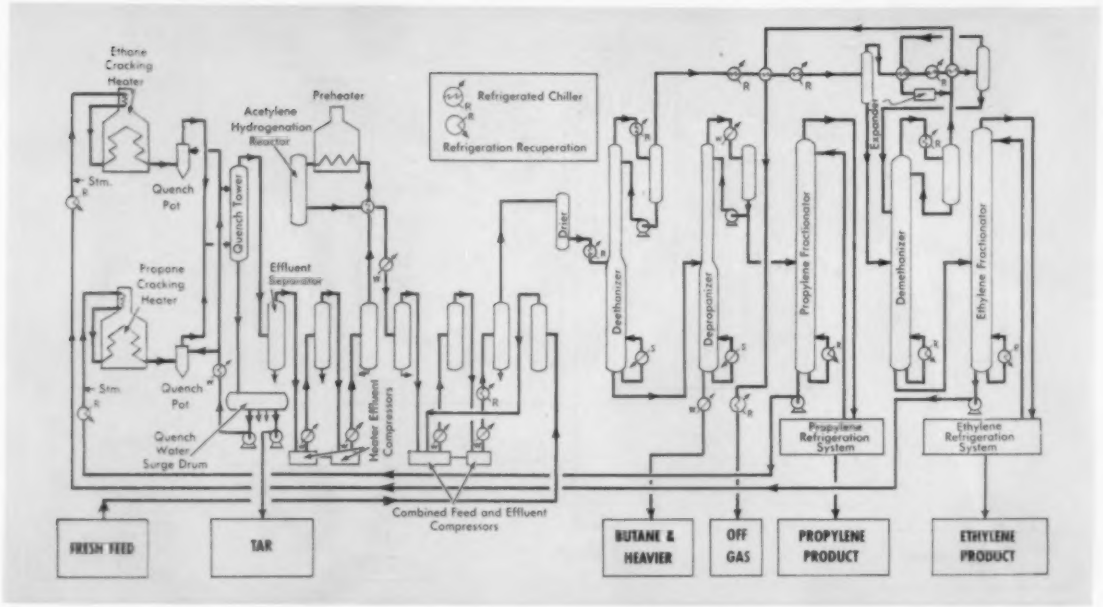
Temperature of the conversion products must be lowered rapidly at the heater-coil outlet. This must be done to prevent loss of olefins due to secondary reactions. A primary quench may be employed to reduce the temperature of the heater effluent to approximately 700° F. This is followed by quenching in the quench tower. In addition to performing the necessary cooling, the water removes most of the tar or heavy distillates from the pyrolysis products. The quench water from the bottom of the quench tower goes to a settling tank where separation is made between the heavier tar and lighter distillate fraction.

Further information on the process may be obtained from Stone & Webster Engineering Corp., Boston.

Yields . . . Ultimate yields from cracking of ethane and propane are approximately 75 and 45 per cent by weight, respectively. Ethylene recovery is in the order of 96-98 per cent at purities in the range of 95 to 99.9 per cent.

Reference

See "Making Ethylene" by H. C. Schutt, consulting engineer and S. B. Zdonik, Stone & Webster Corp.—a series of articles reprinted into an Oil and Gas Journal petrochemical manual.



Ethylene and Propylene

REFINERY off-gases from units wherein petroleum stocks have been cracked are an important source of these olefins. However, in most cases, this source is inadequate and additional ethylene and propylene must be produced by selectively cracking petroleum fractions. Most units produce ethylene from ethane, and ethylene and propylene from propane.

The flow diagram illustrates a plant to produce ethylene and propylene from ethane and propane, and to recover these olefins along with those entering in the fresh feed which is refinery gas.

Description . . . Separate furnaces are used for cracking ethane and propane in order that each can be cracked at the optimum conditions for maximum yield and on-stream time. The effluents from the furnaces are quenched with water in quench pots to 600° F., combined and further cooled in a water scrubbing tower before introduction to the compression system. Polymer and aromatic distillate are collected in the quench-water surge drum and decanted there. Multistage compression with appropriate intercooling and separation is used and where volumes are adequate, centrifugal compressors may be employed. Many ethylene users require essentially acetylene-free material. When this is the case, the acetylene is selectively hydrogenated by passing the cracking heater effluent over a catalyst, generally after the second compression stage. The fresh feed is introduced into the compression system at the stage corresponding to its delivery pressure. Acid-gas removal facilities also may be provided at this point if required.

The combined heater effluent and fresh feed is compressed to approximately 500 psig., chilled and dried over solid desiccants such as activated alumina or bauxite. The dryers consist of multiple desiccant chambers which are regenerated on a predetermined cycle.

The dried feed gas is further chilled and introduced into the deethanizer operating at 450 psig. Hydrogen, methane, ethane, and ethylene are taken overhead and propylene, propane, and C_4 and heavier bottoms are charged to the depropanizer. The deethanizer overhead is then chilled by exchange and ethylene refrigeration to —130° F. Condensed liquid is charged to the demethanizer operating at about 100 psig. The vapor is further chilled to about —195° F. and the condensed liquid also charged to the demethanizer. The residual vapor is expanded in a centrifugal expander to the fuel gas system pressure. The low temperature produced in the expander is used to produce the final cooling of the feed gas to —195° F.

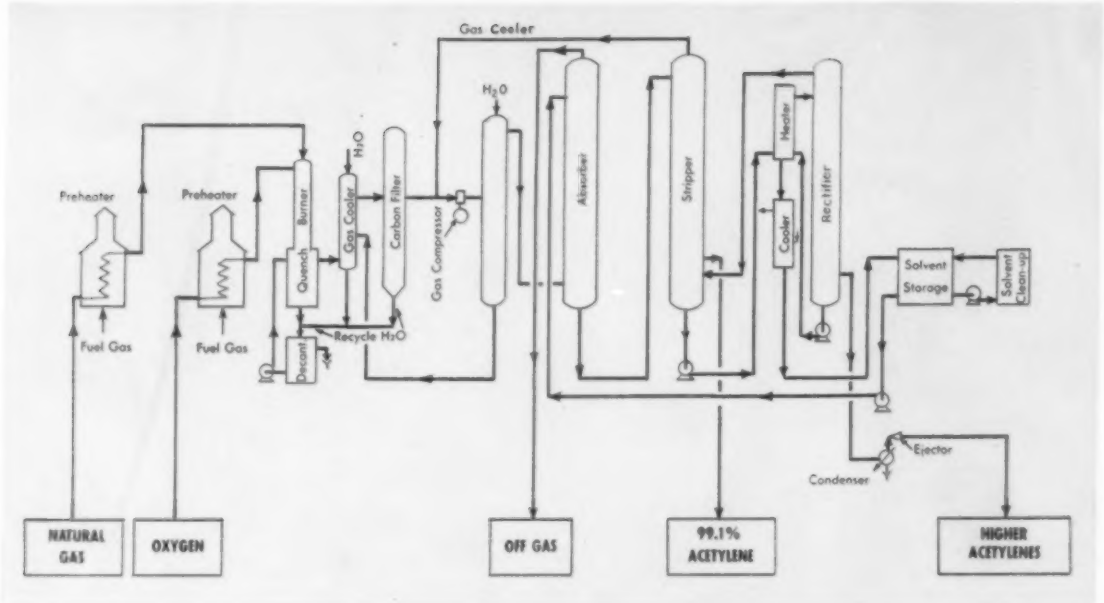
The demethanizer rejects methane to the fuel system and the bottoms, consisting of the recovered ethane and ethylene, is charged to the ethylene fractionator operating at about 60 psig. The ethylene fractionator is integrated with the ethylene refrigeration system to supply reflux and reboil heat. The ethylene product is taken overhead and the ethane bottoms are recycled to the ethane heater.

The depropanizer takes propylene-propane overhead and C_4 and heavier as bottoms. The C_4 and heavier may be further processed to produce a C_4 cut and an aromatic distillate cut. The propylene-propane is charged to the propylene fractionator operating at about 20 psig. Propylene product is taken overhead and propane bottoms are recycled to the cracking heater or withdrawn as L.P.G.

Refrigeration for the unit is supplied by centrifugal compressors operating in a cascade system.

A modification of the fractionation system shown above permits the manufacture of ethylene and propylene from naphtha charge stocks. Ethylene of purities to 99.9 vol. per cent may be produced with this system.

Information on this process may be obtained from the Lummus Co., New York.



Acetylene (B.A.S.F.)

AT TEMPERATURES of about 1,500° C. (2,700°-2,800° F.) a favorable conversion of methane to acetylene can be obtained as follows:

$$2CH_4 \rightleftarrows C_2H_2 + 3H_2 - 95.5 \text{ Kcal}$$

The large industrial acetylene plants based on natural gas in the United States today use the process based on partial oxidation of natural gas with oxygen. Part of the natural-gas feed is burned with oxygen to provide the endothermic heat for the methane-to-acetylene reaction. Quenching and recovery of pure acetylene by means of selective solvent are other steps in this process which was developed by the Badische Anilin & Soda Fabrik A.G., and is referred to as the Sachsse process.

Process description . . . Natural gas and 95 per cent oxygen from an adjacent tonnage oxygen plant are preheated to about 1,100° F. in gas-fired preheaters. They then enter the burner and are: (1) mixed in a diffuser section, (2) pass through a multiplicity of small tubes in a specially designed burner block, and (3) are ignited. Design of the burner block is such that the velocity of the gas mix going through the tubes is higher than the flame velocity of the mix. The burner is designed to prevent flashbacks, and stabilize the reaction flame. A high-velocity water spray provides the necessary quick quench.

Soot removal . . . A small amount of soot is formed. About one-third of this soot is removed with the quench water. The quench burner gas, saturated with water and carrying the remainder of the soot, is cooled and goes through a soot filter. Here it is passed countercurrent through a moving bed of granular coke.

Burner-gas composition . . . A typical burner-gas composition is given as follows (in volume per cent):

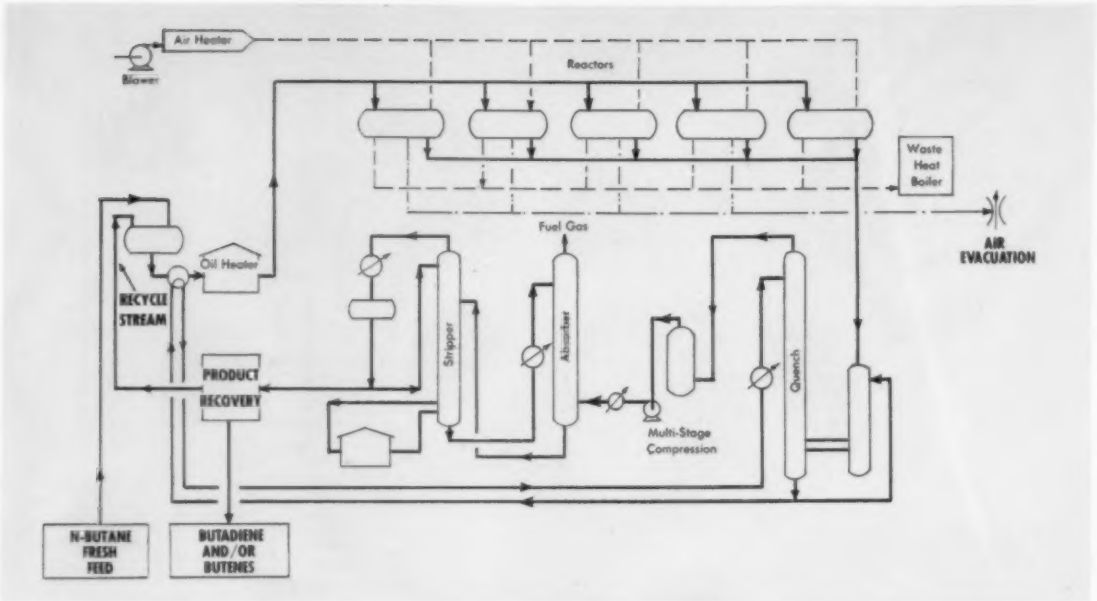
	Natural gas	Burner gas
CH_4	93.8	4.4
C_2H_6	3.9	
C_3H_8	1.1	
C_2H_{10}	0.2	
O_2		0.3
CO_2	1.0	3.9
CO		25.9
H_2		54.8
N_2		1.4
A		0.67
C_2H_2		8.0
C_2H_4, etc.		0.63
Total	100.0	100.0

Product recovery . . . A number of burner units are used and the gas from these combined to a multistage centrifugal compressor. A selective solvent in the absorber absorbs more than 99 per cent of the acetylene made in the burners plus all of the higher acetylenes and some carbon dioxide. The absorber offgas, high in H_2 and CO, is a suitable synthesis gas for ammonia and methanol production. Carbon dioxide and less soluble components are stripped by an acetylene-rich gas stream in the stripper. The stripper overhead is recycled to suction side of the burner effluent compressor.

Bottom liquid from stripper is heated by recycle hot lean solvent before being stripped and rectified. Higher acetylenes are withdrawn from the rectifier, together with the stripping steam, by a vacuum ejector and flared. This stream contains essentially no acetylene.

The purity of acetylene made is 99.1 per cent or better.

More information on this process can be obtained from Chemical Construction Corp., New York.



Butadiene and Butenes From Butane

THE HOUDRY dehydrogenation process is an adiabatic fixed-bed catalytic process that may be operated selectively to produce butadiene and butenes, either separately or concurrently, or other mono and diolefins.

This cyclic, continuous process employs pelleted catalyst made of active alumina impregnated with 18-20 per cent chromic oxide. Catalyst is regenerated in the reaction chambers by burning off coke deposit with preheated air. Ceramic-tile linings of reaction chambers avoid expensive alloy construction and guard the catalyst from iron contamination.

Process flow . . . In a typical operation for butadiene or butenes from n-butane charge, the fresh feed and butane-butene recycle are preheated to reaction temperature prior to contact with catalyst in the horizontal fixed-bed reactors.

Effluent from the reactors is cooled in a quench tower by direct contact with circulating oil, then passes to a knockout drum and a compression-cooling system. Uncondensed gases go to an absorber and stripper for recovery of C_4 and heavier material. Stripper effluent and condensed liquids are depropanized, and then go to the product-recovery and purification system.

Power-operated valves are controlled by a special cycle timer which programs the reaction, purging, and regeneration sequences. Hydrocarbons are purged from the on-stream reactor prior to regeneration, and combustion gases are purged after regeneration.

Operating conditions . . . Operating conditions are chosen to give essentially adiabatic operation, with the heat required for reaction being virtually the same as that supplied by combustion of coke deposit during catalyst regeneration.

To maintain desired heat capacity of the catalyst bed, a catalytically inert material may be mixed with the pelleted catalyst to function as a heat-storage medium, absorbing heat during regeneration and releasing it during reaction.

Major process conditions normally will be within the following ranges: temperature, 1,000°-1,200° F.; pressure, 5 in. Hg abs. and higher; space rate, 1-3 vol. charge/vol. catalyst/hour; on-stream period, 7-15 minutes.

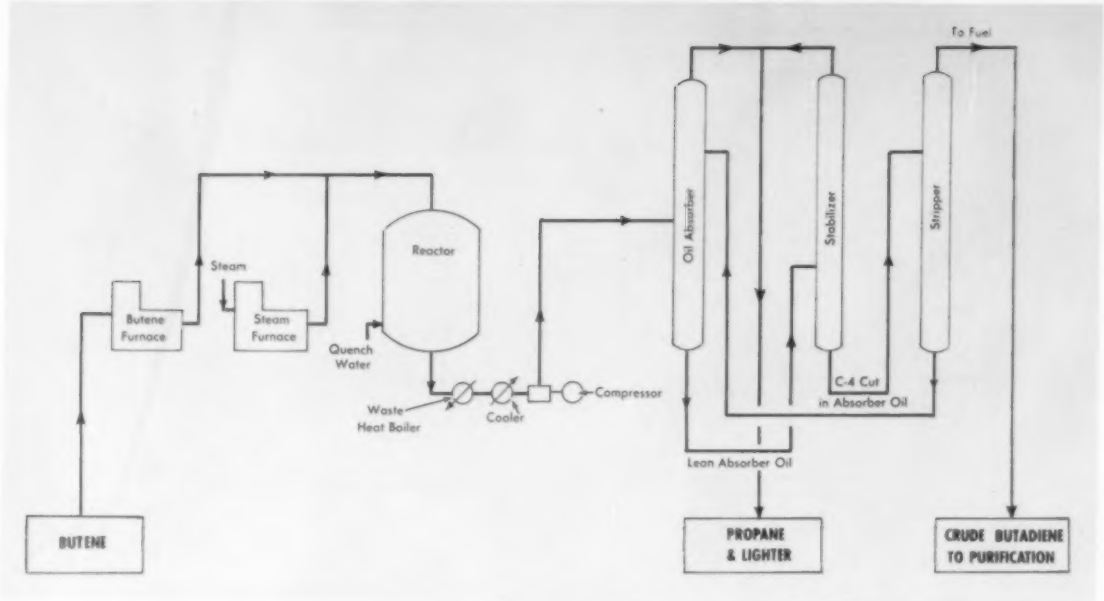
Temperature variation throughout the cycle is held within 50° F., thereby providing optimum temperature level for high conversion, holding coke deposit low, and maintaining catalyst activity at high value.

Typical yields of butadiene and butenes in dual-purpose commercial operation, using Houdry dehydrogenation catalyst, are shown in the accompanying table.

TYPICAL COMMERCIAL DATA FOR PRODUCTION OF BUTADIENE AND BUTENE*

	Weight per cent		Calculated ultimate yield wt. per cent butane feed
	Total reactor feed	Total reactor product	
Hydrogen	...	1.5	4.5
Methane	...	2.5	7.4
Ethane-ethylene	...	2.3	6.9
Propylene	...	2.2	6.5
Propane	...	0.4	1.2
Isobutane	2.0	1.4	...
Isobutene-butene-1	†1.5	9.7	24.4
Butadiene	0.4	8.4	23.8
n-Butane	83.9	50.9	...
Butene-2	12.2	19.2	20.8
C_5+	...	0.3	0.9
Coke	...	1.2	3.6
Total	100.0	100.0	100.0

*Yields shown are average of daily yields for 1 week, taken after several months of plant operation. †In this operation butene-1 and isobutene are selectively removed as product. When maximum butadiene is desired, all butenes are recycled to the process.



Butadiene From Butenes

THIS IS A PROCESS for the catalytic dehydrogenation of normal butenes to butadiene-1,3.

The charge is a C_4 hydrocarbon stream containing about 80 weight per cent n-butenes.

The product is a crude butadiene stream from which high-purity butadiene can be extracted.

The over-all process scheme for manufacture of butadiene from butenes consists of: (1) feed preparation, (2) dehydrogenation and gas recovery, and (3) butadiene purification.

In the feed preparation the normal butenes (butene-1 and butene-2's) are separated out of the butane-butene stream coming from a refinery or other source of feed stock. Isobutene in the feed may be removed by conventional cold acid polymerization.

Purified butenes from the feed preparation section along with unreacted butenes from the butadiene purification section are combined as total feed to the dehydrogenation section. This description deals only with the dehydrogenation and gas-recovery step.

Process description . . . The feed is preheated to about 1,000° F. in the hydrocarbon superheater. The hot gases are then mixed with superheated steam and the mixture is passed through the fixed-bed catalyst.

The low partial pressures necessary for the dehydrogenation of the butenes to butadiene by the catalyst are obtained by the use of this steam. Carbon deposited on the catalyst is removed by a "water gas reaction" with steam, partially during the dehydrogenation and partially during the regeneration cycle.

The hot gases leaving the reactor go through steam generators where they are cooled and where some of the steam for the process is generated. The hot reactor effluent is further cooled in an oil-quench tower and a water-quench tower. Water condensed from the effluent after compression is stripped of any volatile hydrocarbon in a water stripping tower and is then discharged to a blowdown system.

After compression and cooling, the effluent enters a condensate separator. The gases from the separator are fed to the absorber where the C_4 hydrocarbons are absorbed in a light naphtha which is then recycled to the oil-quench tower. The condensate from the separator, containing the unstabilized C_4 cut, is fed to the stabilizer where the lighter components are removed overhead.

The bottoms stream from the stabilizer is fed to the rerun tower where the C_5 and heavier components are removed as bottoms. The overhead stream is the crude butadiene product.

The principal operating conditions are:

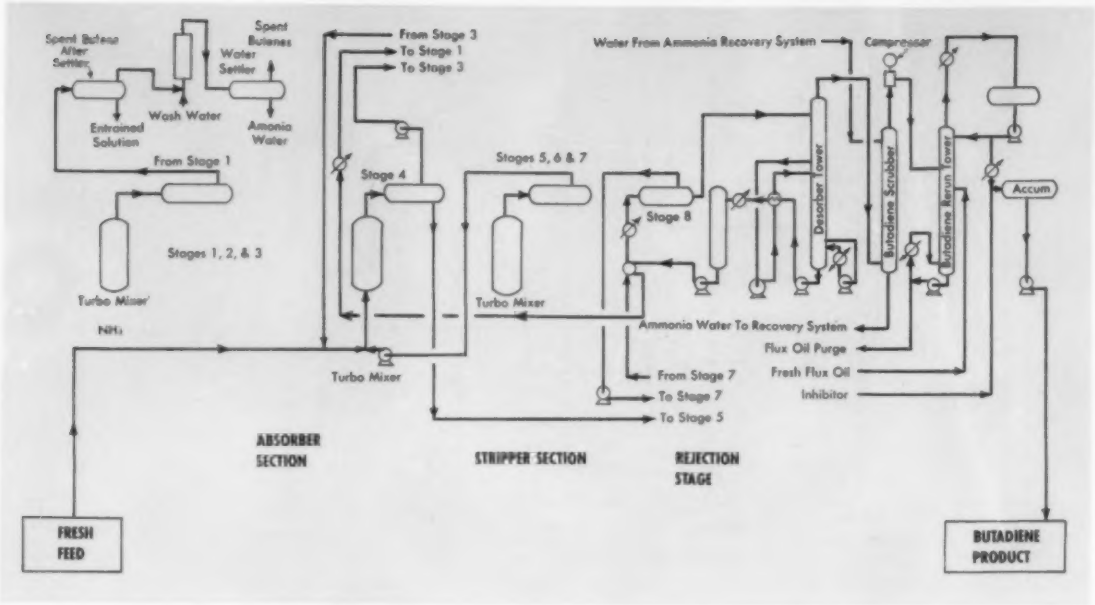
Space velocity, V/H/V (volume of n-butene as gas at standard conditions per hour per volume of catalyst)	125-225
Pressure above bed, psig.	7-11
Pressure below bed, psig.	2-4
Partial pressure, mm. Hg (at reactor inlet)	60-80
Steam/butene, gas volume ratio	14-18
Temperature, °F.	1,150-1,250

Typical once-through yields* are as follows:

	—Weight per cent— Feed	Products
Normal butenes	80.0	60.0
Butadiene	2.0	16.4
Other C_4's	18.0	16.0
Polymer		1.0
Fuel gas and coke		6.6

*Yields and operating conditions will depend upon the catalyst used.

More information on this process may be obtained from Esso Research & Engineering Co., New York.



Butadiene Extraction

THIS is a liquid-phase selective solvent-extraction process for recovering butadiene.

The charge is a butane-butene-butadiene cut produced by catalytic dehydrogenation of normal butenes or by high-temperature cracking of naphtha or gas oil.

The product is butadiene of 98.5+ per cent purity.

The three major components of the charge stream, butadiene, butanes, and n-butenes, have close boiling points and it is necessary to use a solvent which will selectively absorb the butadiene. The solvent used is an aqueous ammoniacal cuprous acetate solution of this approximate composition:

	Moles per liter	Weight per cent
Total copper	3.3	17.5
Cuprous copper	3.0	...
Acetate (acetic acid)	4.0	20.0
Ammonia	11.0	15.5
Water	31.3	46.9
Total	....	100.0

To obtain maximum recovery and selectivity with the C.A.A. solvent, the extraction is carried out in a countercurrent mixer and settler system at low temperature. Following extraction of the butadiene by the solvent, the extract solution goes to the desorber and the butadiene is removed from the solvent. The butadiene stream then goes to a rerun tower for final purification (removal of acetylenes, etc.).

Description . . . In the absorber section, the stripper section, and the rejection stage, the butadiene is concentrated and absorbed by the solvent while the majority of the butanes and butenes are rejected from the system. The solvent is mixed with the hydrocarbon feed in a series of stages, each of which consists of a turbo mixer and a settler. The hydrocarbon not absorbed by the solvent is recycled back to other stages for additional contacting with the solvent until essentially all the butadiene is finally absorbed. The hydrocarbons that are rejected are water washed and then are recycled to the catalytic dehydrogenation plant or are divided to alkylation plant feed.

The solvent containing the butadiene is fed to the desorber tower where the hydrocarbon stream is separated from the solvent. The hydrocarbon stream is sent to the butadiene scrubber where water washing removes ammonia.

From the scrubber the butadiene stream goes to the butadiene rerun tower where polymers and other high-boiling impurities are removed. A flux oil is used as a wash in the bottom of the rerun tower. After the addition of an inhibitor, the final product is sent to storage.

The principal **operating conditions** are:

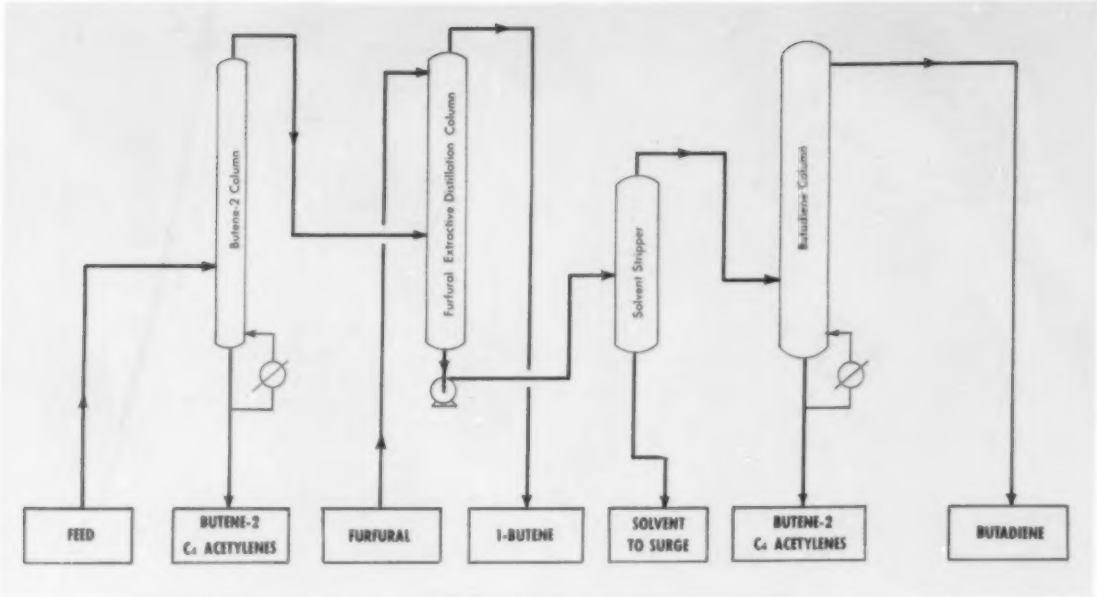
Ratio of copper solution to feed, lb./lb.	8.0
Lean solution temperature, °F.	8
Lean solution pressure, psig.	45
Rejection temperature, °F.	100
Desorber bottom temperature, °F.	175
Desorber bottom pressure, psig.	15

Type yields and analyses of the feed and products are as follows:

	Feed, mole per cent	Spent butenes product, mole per cent	Butadiene product, mole per cent
C_3	0.2	0.3	0.3
Butadiene	16.7	0.9	98.5 (Min.)
i-Butene	4.9	5.7	0.2
n-Butenes	62.8	75.1	1.0
Butanes	15.3	17.9	...
C_5	0.1	0.1	...
	100.0	100.0	100.0

Butadiene recovery (per cent of butadiene in feed)—98 per cent.

Information on process may be obtained from Esso Research & Engineering Co., New York.



Butadiene Recovery

THIS IS a process to recover butadiene from a stream of mixed hydrocarbons. The charge is a depropanized C_4 fraction from a dehydrogenation or cracking operation. The product is a polymerization-grade butadiene of a minimum purity of 98 weight per cent.

Description . . . The Furfural extractive distillation process may be applied to recovering butadiene from either a naphtha cracking operation or n-butane dehydrogenation. In either case the material from which butadiene is to be recovered is subjected to prefractionation to remove propane and lighter components from the feed.

The depropanized feed stream containing all seven C_4 isomers enters the butene-2 column where the butadiene fraction is concentrated. The reboiler product contains most of the high-boiling butene-2, as well as part of the low-boiling butene-2 and C_4 acetylenes. Part of the normal butane goes overhead and part goes out with the kettle product.

The overhead from the butene-2 column is charged to the extractive distillation column. This column acts as an absorber, preferentially absorbing butadiene and small amounts of the other C_4 unsaturates.

The rich solvent leaving the bottom of the extractive distillation column is pumped to a stripping column where the hydrocarbons (butadiene, butenes-2, and traces of other C_4 hydrocarbons) are stripped from the solvent and sent to the final separation step (the butadiene column). In the butadiene column, butenes-2 and C_4 acetylenes are removed as a reboiler product and butadiene of a minimum purity of 98 weight per cent is yielded as a side draw near the top of the column.

The use of stream analyzers controllers (ultraviolet and infrared instruments) has been developed successfully to obtain good column control for the close separations involved. Nearly instantaneous sample analysis is possible with these sensitive onstream analyzers which indicate changes in the composition of the C_4 streams being handled.

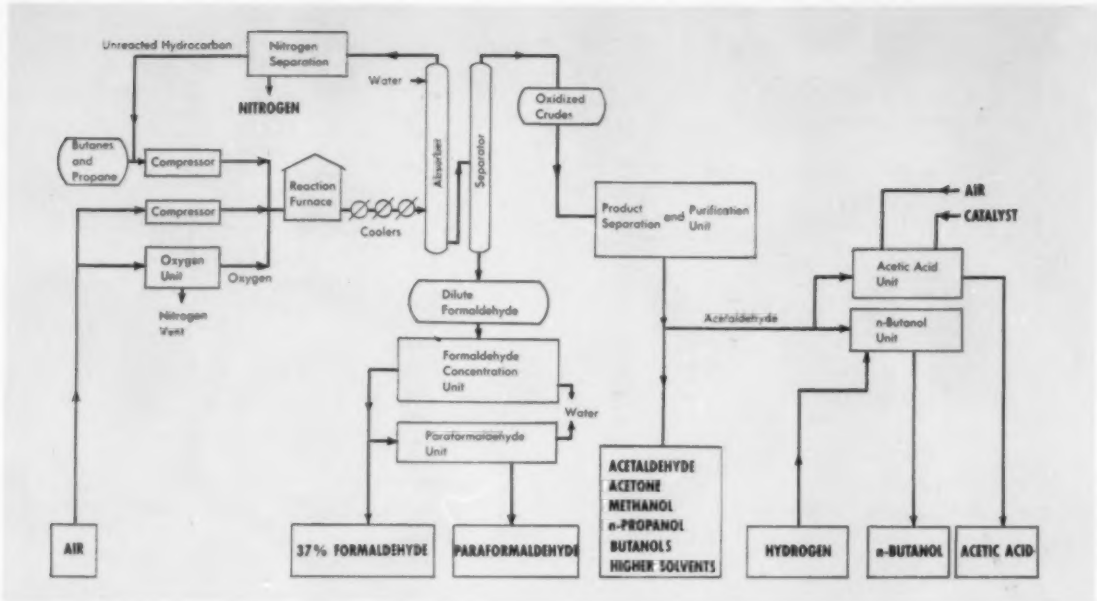
Thus, for example, ultraviolet onstream recording controllers may be used on the butene-2 column and the furfural absorber (extractive distillation column). For instance on the butene-2 column a system may be used in which an ultraviolet recording controller resets a flow recording controller on the feed to the column to maintain a constant low-butadiene concentration in the bottom product according to the analysis of a vapor sample taken from selected plate of the column.

TYPICAL ANALYSES OF FURFURAL EXTRACTIVE DISTILLATION SYSTEM (MOLE PER CENT)

	Extractive distillation column		Furfural stripper
Component—	Feed	Overhead product	overhead product
Isobutane	5.8	8.3	
Isobutylene	6.8	9.8	
Butene-1	29.8	42.8	
Butadiene	26.2	1.2	83.8
n-Butane	15.1	21.6	
Butene-2 (low-boiling isomer)	13.0	14.6	9.2
Butene-2 (high-boiling isomer)	3.3	1.7	7.0
	100.0	100.0	100.0

Commercial installations . . . About 66 per cent of all the butadiene produced in the United States is recovered by Furfural extractive distillation.

More information on this process may be obtained from Perco division, Phillips Petroleum Co., Bartlesville, Okla.



Oxidation of Propane and Butane

ORGANIC aliphatic chemicals have been produced by the oxidation of propane and butane since 1945 in the Chemcel plant of Celanese Corp. of America, located near Bishop, Tex.

The principal products from the hydrocarbon oxidation are acetaldehyde, formaldehyde, alcohols, glycols, acetone, and special solvents. The initial plant manufactured glacial acetic acid as a derivative of acetaldehyde, and since then several other processing units have been constructed to upgrade other primary products, notably formaldehyde to several forms.

Process description . . . The oxidation operation is continuous and begins with the compression of air. Part of the air is supplied directly to the reaction furnace and part to a tonnage oxygen plant. The propane, n-butane, and isobutane feed streams are also compressed for supply to the reaction operation. Here an excess of the hydrocarbons is mixed with the air and oxygen streams. The partial oxidation of the hydrocarbons is controlled by varying the ratio of hydrocarbons-to-air-to-oxygen and varying the temperature and pressure of the mixed streams.

During a brief residence time in the furnace, the flowing stream becomes enriched with oxygenated products. The entire reactor output is cooled and absorbed in a tower containing water. The gases leaving this absorber are further separated into nitrogen, which is vented, and unreacted hydrocarbons which are recycled to the reaction. The aqueous stream from the absorber is separated into a dilute, aqueous formaldehyde stream and another wet stream containing all other oxidized crude products.

The dilute formaldehyde stream is concentrated and purified to produce a 37 per cent solution of formaldehyde in water for sale as formalin. The formalin is both sold and sent to another formaldehyde concentration unit where additional water is removed. This unit produces a 91 per cent formaldehyde, solid product which is known as paraformaldehyde.

The oxidized crudes are separated and purified in a separate unit employing the unit operations of fractionation, azeotropic distillation, solvent extraction, and absorption. This product separation and purification unit gives aldehydes, alcohols, ketones, oxides, and glycols ready for marketing.

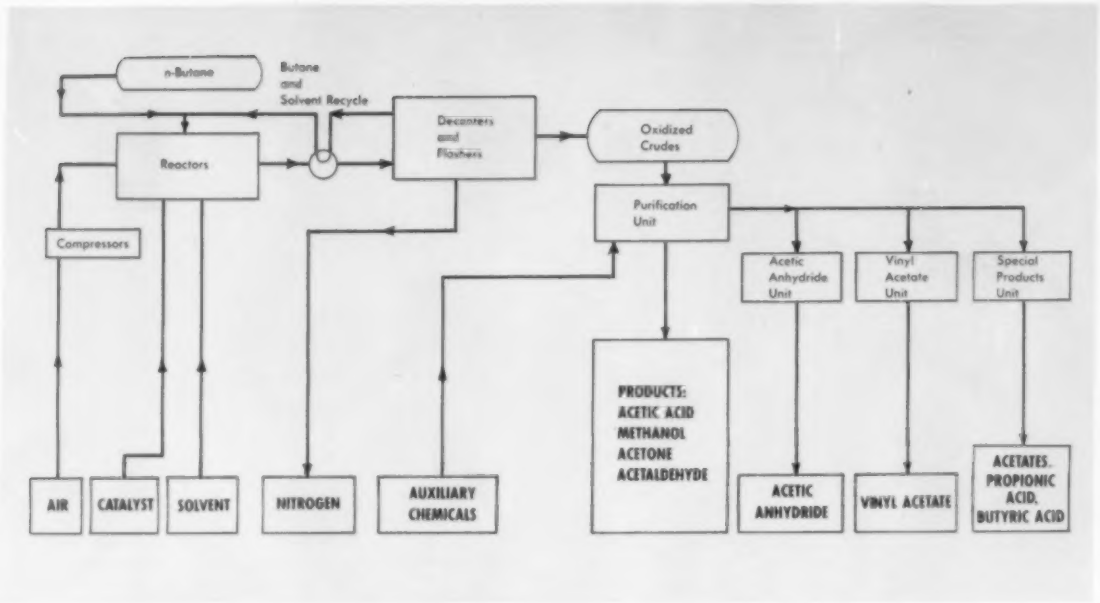
Several of these salable, oxygenated products are further upgraded to diversify the market pattern. As an example, acetaldehyde is converted at high yields in a separate unit to acetic acid employing air and catalysts. Also, acetaldehyde is aldoled and hydrogenated to n-butanol. Several acetate esters are derived from the acetic acid and various alcohols produced in the initial hydrocarbon oxidation.

Corrosion prevention was a major problem in the development of the oxidation process and to assure its reliable operation. The aldehydes and acids formed in the primary reaction are highly corrosive at elevated temperatures. Stainless steels, chrome nickel, chrome-nickel-moly alloys, and monel are used widely in the product recovery and purification equipment.

In several instances entirely new designs of heat exchangers were necessary to meet special conditions.

Large quantities of steam and cooling water are used in both oxidation operation and in the product-purification units. Much of the steam is used in processing and is not available as condensate for boiler feed water. Significant chemical treating economy is obtained by blending well water, having a large excess of sodium bicarbonate with river water which would otherwise have to be treated with soda ash to soften it. When a proper mixture of well water and river water is used, only lime treatment is required for boiler feed water.

A new unit to produce trimethylolpropane is being constructed for operation late in 1957.



Oxidation of Butane

THE PRODUCTION of petrochemicals and their derivatives was begun at a plant 6 miles from Pampa, Tex., in November 1952 by Celanese Corp. of America.

The basic process is air oxidation of n-butane to produce primarily glacial acetic acid, methanol, acetone, and acetaldehyde. Other units convert primary reactor products into derivatives.

Process description . . . The hydrocarbon fed to the reaction section is 95 per cent n-butane with some isobutane, pentane, and higher hydrocarbons being permitted. Basic design capacity is 1.8 million pounds per week of acetic acid. The liquid hydrocarbon feed stream is mixed with compressed air and catalyst in reaction vessels.

Here the primary reaction takes place under controlled temperature and pressure conditions. The reactor product stream passes through heat exchange prior to separation. In a decanting and flashing train the reaction stream is separated into three streams: nitrogen for venting, crude oxidized products, and unreacted-hydrocarbon and solvent mixture.

Principal Unit Operations

This latter stream is used as heat exchange prior to recycling of hydrocarbon and solvent to the reaction vessels. The oxidized crude stream is separated into marketable products and higher-boiling fractions in a purification unit. The principal unit operations employed are extraction and distillation to produce glacial acetic acid, methanol, acetone, and acetaldehyde as salable reaction products.

The glacial acetic acid is converted at high efficiencies to acetic anhydride in a separate unit. This unit has capacity to convert all of the acetic acid to acetic anhydride if the product balance so requires. Primary reaction products and auxiliary chemicals are taken to a separate unit for production of vinyl acetate.

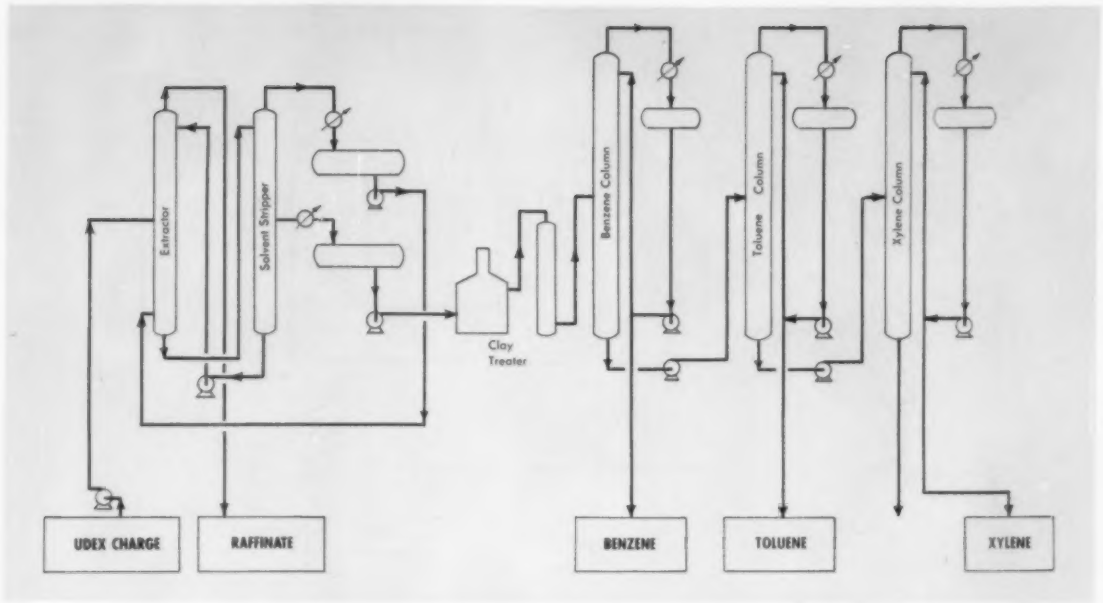
Another unit for special processing is employed for recovery of primary reaction products that are in too small volumes to justify separate units, and for the production of derivatives of the primary reaction products. This versatile unit is comprised of reaction and storage tanks, two fractionating towers, and auxiliary equipment. The piping has been designed for processing flexibility so that the operation of the unit may be readily arranged to meet sales needs. The processing may be either batch or continuous as needed.

The original design of the plant employed several unusual features which have proven quite satisfactory in commercial use. Extensive use of air-cooled process heat exchangers was dictated by the arid location of the plant. Water makeup requirements are greatly reduced by having 80 per cent of the process cooling duty in air-cooled exchangers. Subcooling and certain critical controls in the processing sequence are effected by the usual water-cooled heat exchangers.

Perforated plate, or sieve tray, fractionating columns were used extensively throughout all units. Sieve tray columns are easy to maintain because of their relatively simple construction. Their operating capacity and performance may be easily changed to meet varying process requirements by inserting blanking strips on the trays. Lines throughout the plant are overhead to prevent underground corrosion and to enable detection of leaks due to corrosion. All reaction equipment plus most of the recovery and purification equipment is fabricated of stainless steel.

Special insulating techniques and comparatively large amounts of insulation were required for the portions of the plant handling acetic acid. The glacial acetic acid product freezes at 60° F. and the comparatively low temperatures and higher wind velocity encountered in the Texas Panhandle made special planning necessary. Product acetic acid and acetic anhydride are shipped in aluminum tank cars.

A new unit for the production of methyl acrylate, ethyl acrylate, and higher acrylates will be constructed and placed in operation late in 1957.



Udex Extraction

THE PROCESS utilizes an efficient multistage countercurrent extraction column of special design to intimately contact the hydrocarbon feed with the solvent. Lean solvent, fed to the top of the column, selectively dissolves aromatic hydrocarbons, removing them in the rich solvent stream from the bottom of the column. Hydrocarbon feed is introduced at an intermediate point of the extractor and hydrocarbon reflux is introduced near the bottom of the column. The nonaromatic portion of the feed—raffinate—is produced as the overhead product of the extraction column.

The rich solvent from the extractor is processed in the stripper, wherein dissolved aromatics are separated from the solvent, and hydrocarbon reflux also is separated for return to the extractor. The vapor streams from the stripper yield two phases upon condensation —the hydrocarbons mentioned above and a water phase. The water is used in part in a wash column, to recover traces of dissolved glycol contained in the raffinate, and sometimes to similarly wash the extract. The remainder of the water phase is returned to the base of the stripper. The bottom stream for the stripper is lean solvent of the desired composition to effect the required separation between aromatic and nonaromatic hydrocarbons in the feed. It is returned to the top of the extraction column.

The separated aromatic phase can be distilled in a train of three columns, in succession making pure benzene, toluene, and C_8 aromatics, as the overhead products. With the fractionation control system developed by Universal, no intermediate cuts are necessary and the columns will adjust themselves automatically to wide variations in feed composition without deviation from product specifications.

Commercial operations . . . These have demonstrated that aromatics of purity exceeding the requirements of the A.S.T.M. Nitration Grade specifications are produced consistently. Benzene of 5.4° C. solidification point and other test specifications of comparable high purity are maintained. The toluene is of substantially equal purity.

This process is designed and licensed by Universal Oil Products Co., Des Plaines, Ill.

TABLE 1—UDEX EXTRACT AND RAFFINATE PROPERTIES

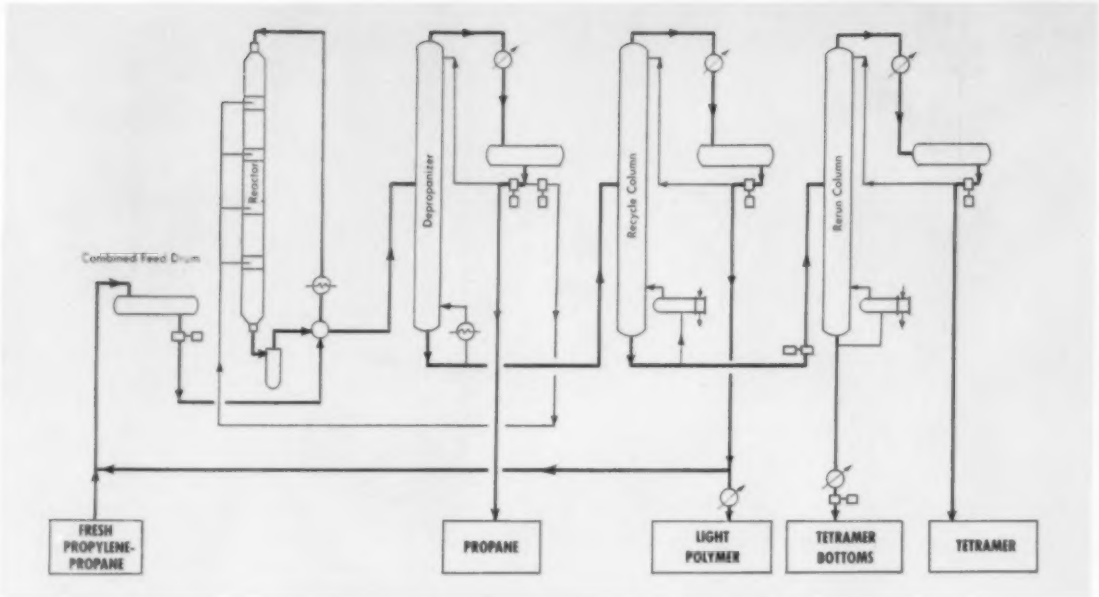
Product Properties—	Udex charge	Raffinate	Benzene	Toluene	Mixed xylenes
Gravity, °A.P.I.	51.9	76.4			
Specific gravity, d 20/4	0.7715	0.6806	0.885	0.873	0.873
Per cent aromatics	51.3	3.5	99.9	99.8	99+
Solidifying point, °C.			5.49		
Distillation—	°F.	°F.	°C	°C.	°C.
I.b.p.	150	145	79.7	110.2	(*)
50 per cent	210	170	80.1	110.8	
Dry point	302	295	80.3	111.0	
Acid wash color—					
Color of acid phase			0	0+	0+
Color of hydrocarbon phase			0	0	0+

Acidity, m.g.s.—NaOH/100 ml. sample—No free acid
Copper strip—Corrosion—Passed

*Ethylbenzene, 14.5 wt. per cent; p-xylene, 19.0 wt. per cent; m-xylene 42.0 wt. per cent; o-xylene, 24.5 ft. per cent.

TABLE 2—UDEX YIELDS

Yields—	Per cent by volume of extract	Per cent by volume of Udex charge	Per cent recovery in extract
Benzene	15.3	7.6	99+
Toluene	42.5	21.2	98
Xylenes and ethylbenzene	40.4	20.0	94
C_9 plus aromatics	1.8	0.9	75
Total extract	100.0	49.7	—
Raffinate		50.3	
Udex charge		100.0	



Specialty Polymers of Propylene

THE U.O.P. catalytic condensation process, utilizing solid phosphoric acid catalyst, may be used to manufacture a variety of specialty poly-propylenes. Propylene tetramer was the first of these specialty polymers to attract commercial interest, being widely used as a base for synthetic detergents of the sulfonated dodecylbenzene type. More recently, propylene trimer has become important as a raw material for the manufacture of nonylphenol and decyl alcohol. Heavier boiling specialty polymers, such as pentamer, are increasing in prominence in the manufacture of other controlled-property detergents.

Process description . . . The propane-propylene feed stock is treated for the removal of hydrogen sulfide and basic nitrogen compounds before being charged to the catalyst section. Caustic and water washing are generally adequate for this purpose.

A propylene tetramer unit is illustrated in the diagram. The purified charge stock flows to a combined feed surge drum where it is mixed with a recycle stream of light polymer. The combined feed mixture is then pumped through appropriate heat-exchange equipment to the catalyst chamber. The phosphoric acid catalyst is held in beds in this reactor and the reaction temperature is controlled by appropriate quench with a low-olefin-content propane stream.

The reactor effluent passes to a depropanizer in which residual propane is separated. Part of this is used as quench to the reactor, the remainder being produced as a net stream of L.P.G. The depropanizer bottoms stream passes to one or more fractionating columns for separation of the total polymer into fractions of various boiling range.

In the diagram, two polymer fractionation columns are shown, the first of which removes as overhead distillate the light polymer boiling up to the initial boiling point of the tetramer product; this light polymer is used principally for recycle to the combined feed drum, the remainder being withdrawn as net light polymer product. The crude tetramer bottoms stream from this fractionator is then led to a tetramer rerun column. It removes specification product as an overhead stream, rejecting a small amount of heavy polymer as bottoms product. At least one additional fractionating column is required when making trimer, the complexity of fractionation being determined by the specifications to be met by the ultimate trimer product.

Pentamer can also be produced by modification of the process conditions in a plant basically designed for tetramer production. Characteristic yields for the tetramer operation are given in the table.

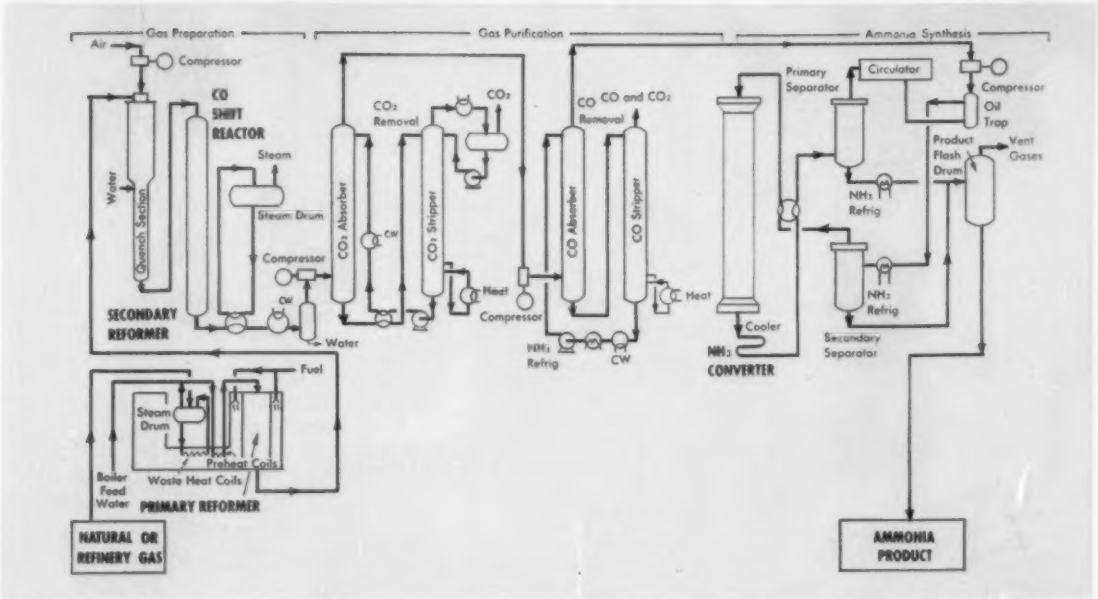
This process is designed and licensed by Universal Oil Products Co., Des Plaines, Ill.

CHARACTERISTIC YIELDS

Fresh feed	Volume per cent	Products	Volume Per cent
Propylene	49.3	Tetramer 350°-480° F.	29.1
Propane	50.7	Heavy polymer 480° F.-e.p.	1.3
		Light polymer i.b.p.—350° F.	0.3
		Propane L.P.G.	54.6

The reactor indicated in the flow sheet is of the chamber type. The later units embody changes in the quench and recycle stream systems. Catalyst life is considerably greater than in earlier catalytic polymerization units.

Cumene manufacture . . . This polymerization unit can also be used for the manufacture of cumene. The feed in this case would consist of benzene and a propane-propylene stream which is relatively free of ethylene and butylene. The existing depropanizer could be used and this would be followed by a benzene column and a rerun column.



Synthetic Ammonia—Gas Reform

IN THE PROCESS, saturated and unsaturated hydrocarbons are decomposed by steam according to the basic equation:

$$CH_4 + H_2O \rightarrow CO + 3H_2$$

It is normally advantageous with starting materials having a wide range of methane concentration (e.g., natural gas, refinery gases and coke-oven gas).

In the first step, the primary reformer converts about 70 per cent of a natural-gas feed into raw synthesis gas, in the presence of steam and using a nickel catalyst.

Primary reformer effluent is then charged to a secondary reformer where air is introduced. The heat of combustion of the partially reformed gas supplies the energy needed to reform the remainder of the gas after combining with oxygen in the air.

The high-pressure reforming process utilizes the potential energy of the relatively high pressures at which natural gas normally is available. Although the synthesis gas must be still further compressed before charging to the ammonia converter, high-pressure reforming conserves 30-40 per cent in compression horsepower over usual practices giving low-pressure synthesis gases.

After leaving the secondary reformer, the mixture is quenched and sent to the shift converter. In the shift reaction, carbon monoxide in the gas streams is converted to carbon dioxide, and simultaneously makes hydrogen (a result of the reaction with steam).

Shift reactor effluent, after heat recovery, is cooled and compressed, then goes to the gas-purification section. Carbon dioxide is removed from the synthesis gas in a regenerative MEA (monoethanolamine) system.

After carbon dioxide removal, carbon monoxide traces left in the gas stream are removed by scrubbing with a regenerative cuprous ammonium acetate solution.

The resulting pure synthesis gas passes to the oil separator, where it mixes with a recycle stream cooled with ammonia refrigeration, and goes to the secondary separator where anhydrous ammonia (contained in the recycle stream) drops out.

Synthesis gas is then passed through heat exchange and charged to the catalytic ammonia converter. Product gas from the converter is cooled and exchanged against converter feed gas.

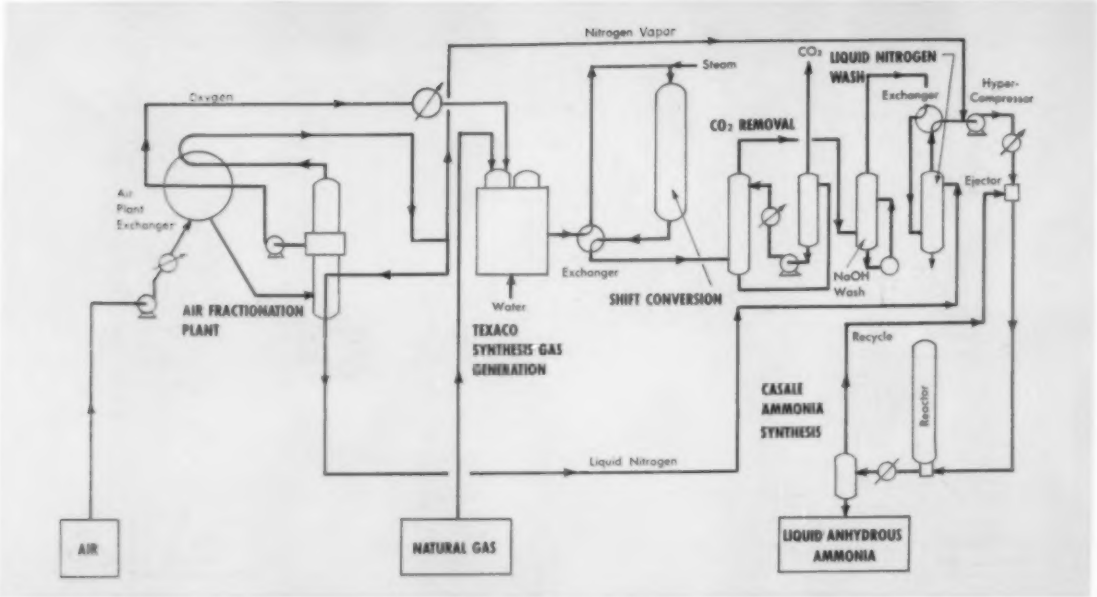
Operating conditions . . . Pressure of the reforming process can handle natural gas in excess of 200 psig. Temperatures in primary and secondary reformers are 1,400°-1,800° F., while shift reaction temperatures are 700°-850° F.

Ammonia synthesis is normally at 4,700 psig., but the converter can be designed for somewhat lower or higher pressures when required.

The "quench type" ammonia converter was developed by Kellogg. Temperature is accurately and flexibly controlled inside the catalyst mass to allow a catalyst basket temperature gradient giving a maximum yield of ammonia per pass, regardless of production rate. Hot spots, common in catalyst baskets having tubular heat exchangers, and a cause of catalyst activity deterioration, are eliminated by the reactor's approach to isothermal conditions.

During World War II, Kellogg built three major ammonia plants using conventional low-pressure reforming. Since that time, five plants have been built, or are under construction, using high-pressure reforming. In addition, one plant has been built to produce 150 tons per stream day of ammonia using nitrogen wash on a hydrogen rich gas.

No licensing arrangements are needed for the plant described. Engineering, design, and construction of this type plant are available from M. W. Kellogg Co., New York City, which has built nine plants using variations of this process.



Ammonia by Partial Oxidation

THIS PROCESS combines the Texaco partial oxidation process with the Casale ammonia synthesis process. The process may be thought of as consisting of six stages: (1) air fractionation, (2) partial oxidation, (3) shift conversion, (4) carbon dioxide removal, (5) liquid nitrogen wash, and (6) ammonia synthesis.

After purification and dehydration, air is liquefied and separated by fractionation into liquid oxygen and gaseous nitrogen. A portion of the nitrogen stream is liquefied for use in Stage 5.

Partial oxidation . . . The liquid oxygen from the air fractionation plant at a pressure of about 400 psig. is preheated and goes to the synthesis-gas generator. Natural gas is compressed and heated; it then mixes with the preheated oxygen in the synthesis gas generator. The hydrocarbon feed gas (it could be a liquid feed such as diesel or fuel oil) is partially burned with the oxygen (under pressure and without a catalyst) to produce hydrogen and carbon monoxide. These are the main products of the high-pressure partial oxidation. The product gas is water quenched, then reheated by exchange with effluent gases from the converter before entering the shift stage.

Shift conversion . . . Steam is added at the shift converter in the presence of a catalyst to complete conversion of carbon monoxide to carbon dioxide with formation of additional hydrogen from dissociation of the water molecule. The synthesis gas leaving the exchanger, following the converter, is cooled to desired temperature for carbon dioxide removal.

Carbon dioxide removal is accomplished by contacting with MEA. The carbon dioxide is stripped from this absorption medium in a reboiler system.

The synthesis gas, now free of the bulk of its CO_2, is caustic washed, dried, heat exchanged, and enters the liquid nitrogen wash system where any unconverted methane, carbon monoxide, and other gases are condensed through contact with liquid nitrogen.

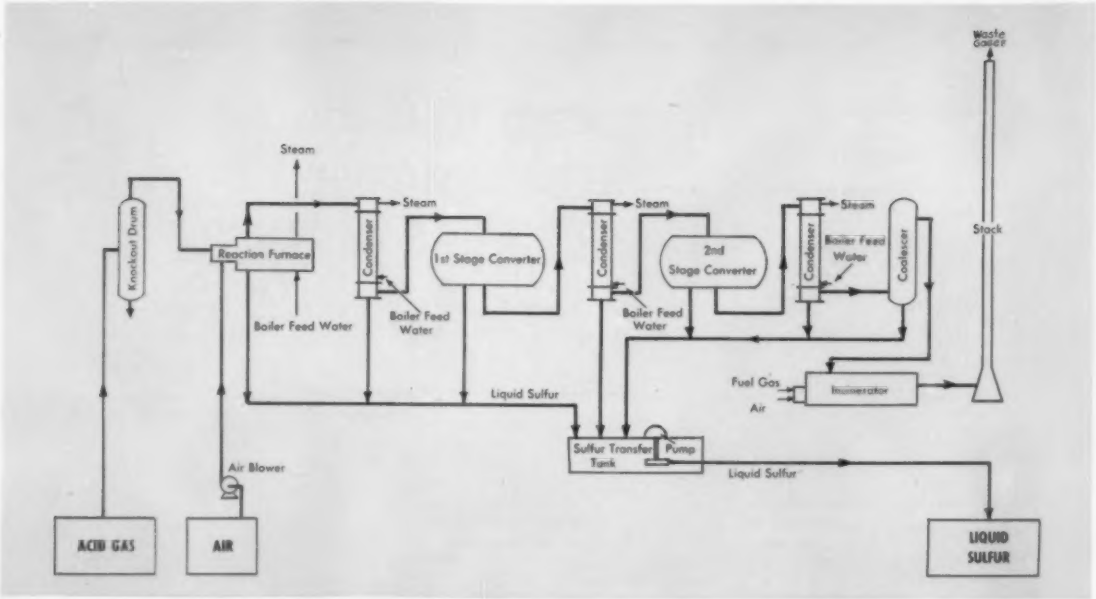
Ammonia synthesis . . . The synthesis gas is highly purified in passage through the liquid nitrogen wash tower. It contains hydrogen and whatever nitrogen was added in the nitrogen wash. It now receives its molecular proportion of nitrogen for ammonia synthesis. In the Casale process the hydrogen-nitrogen mix is compressed to a pressure ranging from 9,000 to 12,000 psig., is cooled to about 100° F., and enters the Casale reactor via an ejector system. In the reactor, which is also a heat exchanger, the nitrogen and hydrogen react, in the presence of a catalyst, to form ammonia.

The ammonia and the unconverted gases are then cooled and separation between liquid and gas made in the separator. The unconverted gases are recirculated through the ejector system. The liquid anhydrous ammonia moves to storage.

The use of liquid nitrogen scrubbing for removal of carbon monoxide, methane, and argon produces a synthesis gas of high purity thus reducing the amount of purge gas from the ammonia synthesis train to a minimum.

Since the complete synthesis gas process requires gaseous oxygen for reforming, gaseous nitrogen for blending into ammonia synthesis gas, and liquid nitrogen for scrubbing, the design of the air-separation plant can be integrated into a highly efficient system.

Information on this process can be obtained from Foster Wheeler Corp., New York, which has built plants to produce over 400,000 tons per year of synthetic ammonia by this process.



Sulfur Recovery

IN THIS PROCESS a high-purity sulfur is produced from H_2S-bearing gases by controlling combustion of hydrogen sulfide with air.

The bauxite catalyst normally is active for several years without regeneration. Contaminants such as propane and higher-molecular-weight hydrocarbons tend to inactivate the catalyst due to carbon deposition in proportion to their concentration in the feed gas.

Operating conditions . . . Combustion of H_2S takes place in a two-pass Scotch marine-type boiler at slightly over atmospheric pressure. Steam is produced at 150 psig., in quantities sufficient to supply the blower requirements of the plant, with an excess of 50 psig. steam. A typical flame temperature is about 2,400° F. Maximum yield is attained by control of burners to provide 2-to-1 ratio of H_2S and SO_2.

With careful operation, particularly in maintaining the ratio of air to acid gas, high conversion ratios of the hydrogen sulfide to elemental sulfur are obtained. Many plants have reported yields in excess of 95 per cent of the sulfur in the feed gas.

Equipment . . . All equipment and lines are carbon steel except for burners which are 18-8 stainless steel.

Under certain circumstances, plants as small as 10 long tons per day have operated profitably. Plants of larger designs are rated as high as 1,000 long tons per day. Forty-one sulfur plants of this type are in operation or being constructed in this country and abroad.

Typical Sulfur Recovery Plant

Process . . . The flow sheet is for a typical sulfur-recovery plant designed to produce commercial-quality sulfur of a minimum purity of 99.5 per cent from an acid gas originating from a petroleum refinery, a chemical plant, or natural-gas operations. The process is basically that of controlled partial combustion of the acid gas with air in the combustion chamber of the sulfur reaction furnace, and then reacting the remaining acid gas with the resultant SO_2 to form sulfur.

This basic over-all reaction is as follows:

$$2H_2S + O_2 \rightarrow 2S + 2H_2O$$

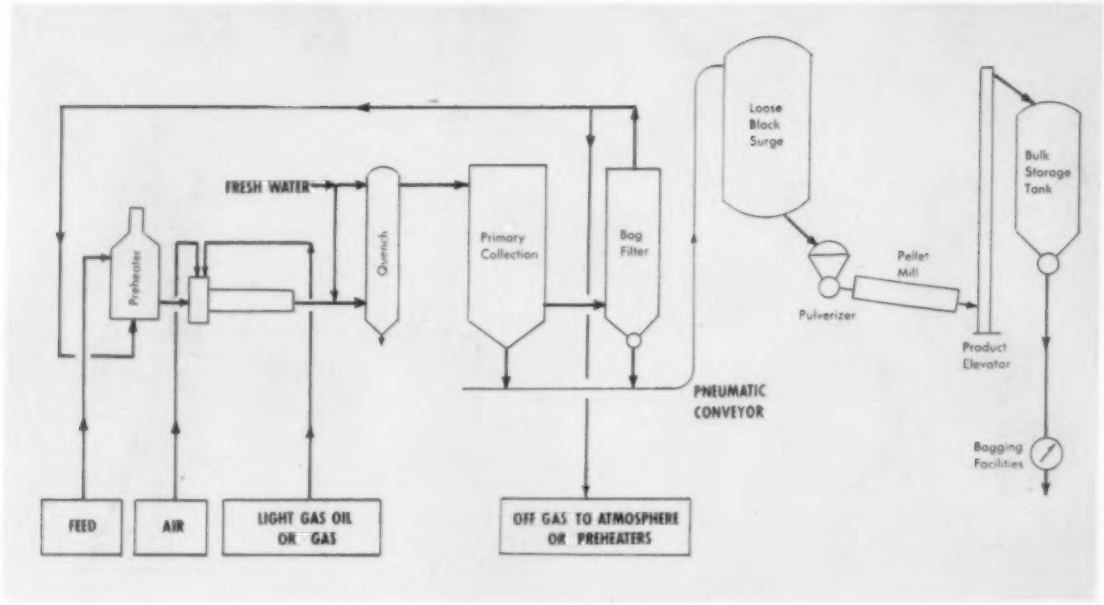
The reaction furnace is equipped with an external combustion chamber attached to its firing tunnel. The combustion gases pass through the firing tunnel and then back through a bank of tubes to the front of the unit. The exothermic heat of reaction that is released in the furnace is removed by generating high-pressure steam for use in the plant.

The hot gases from the reaction furnace are cooled, producing liquid sulfur, in the first stage condenser by generating steam. From the first condenser the gases pass through the first-stage catalytic converter where additional sulfur is produced, and then flow to the second-stage condenser for cooling by further generation of steam.

The gas then flows through the second-stage converter and is cooled in the final condenser by generating low-pressure steam. Entrained sulfur leaving the final condenser is coalesced in the coalescer and the residual H_2S and other sulfur compounds in the tail gases are then converted to SO_2 in the incinerator before being discharged from stack to the atmosphere.

The sulfur produced in the process is withdrawn at various points as it is condensed, coming from the reaction furnace, catalytic converters, condensers, and coalescer, and is accumulated in the sulfur tank. Sulfur transfer pump delivers the molten sulfur to the battery limit for shipment.

No licensing arrangements are needed. Engineering design and construction of this type plant can be had from Ralph M. Parsons Co., Los Angeles.



Carbon-Black Manufacture

THE SIMPLIFIED process flow diagram illustrates the significant features of this process and depicts the major equipment required in the manufacture and collection of carbon black.

Process . . . The Philblack process is carried out by the combustion and thermal decomposition of a hydrocarbon oil being fed continuously into a reactor furnace with a limited supply of air. The limited supply of air, and in some cases the combustion fuel, is admitted tangentially to the tubular-shaped reactor in such a manner that a "whirling" or "cyclonic" flow is imparted. This cyclonic flow, with the combustion of the fuel, forms a blanket of flame and combustion products along the reactor walls that extend from the combustion section into the reaction tunnel. The conversion-oil vapor is introduced axially to the reactor, and initially at least, forms the nonrotating central core or "eye" of the cyclonic flow. It is conceived that the thermal decomposition of conversion oil occurs in the central core. Carbon black, gaseous byproducts, and water vapor are formed from the combustion and decomposition reactions.

Control . . . The temperature within the reactor is controlled by the air-oil ratio, flow rates, and turbulency. These, with reactor design, have a very decided influence on the quality and quantity of the product.

Combustion air is compressed with air blowers and fed to the reactors through tangential ports. A small quantity of "cooling" air is fed to the reactors through axial ports, designed to prevent overheating the oil injection nozzles.

The reactor products are quenched by direct water sprays as the gases egress from the reactor to reduce the temperature and stop the reaction. Atmospheric cooling pipes and smoke headers convey the black-laden gas to the quench towers where final temperature control is obtained with the use of open water sprays.

Collection . . . The major portion of the carbon black is deposited at the base of the primary collection system which consists of cyclone separators. The cyclone-separator offgas, containing approximately 25 to 35 per cent of the carbon black yield, is passed to a bag filter unit which has the function of stripping this remaining quantity of black and permitting the clean offgas to escape to the atmosphere.

The deposited black from the base of the cyclones and bag filters is collected by pneumatic conveyors and passed in a flocculent state to loose-black surge tanks. From the surge tanks the loose black is conveyed to the pulverizers in which the large-sized particles are pulverized. Following the pulverizers, the black is conveyed to the rotating pellet mills where the product undergoes a change from the flocculent state to the dustless, pelleted form suitable for passage to overhead bulk storage tanks prior to being bagged for shipment.

Two types of pelletizing processes are ordinarily employed. In the dry process, as indicated in the flow sheet, the carbon black is fed continuously into a rotating drum where it mixes with pellets already in the drum. Continued rolling compacts the pellets into tiny spheres.

In the wet process a screw conveyor takes the loose black from the surge tank to a mixing box. Water is sprayed into the mixing box. Pellets are formed in two passes in the mixing box. The pellets then go into a rotary drying drum.

Additional information on this process may be obtained from the Perco division of Phillips Petroleum Co., Bartlesville, Okla.

which of these
can't be stored in a
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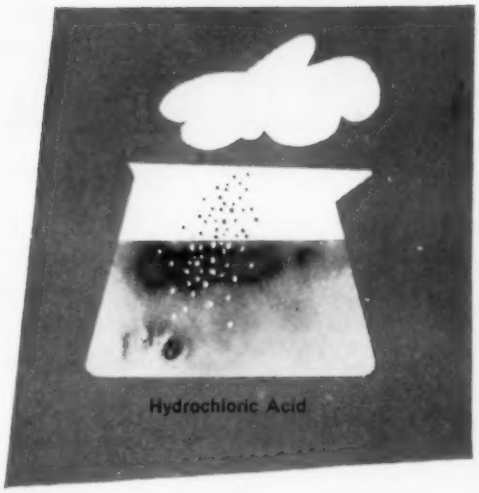

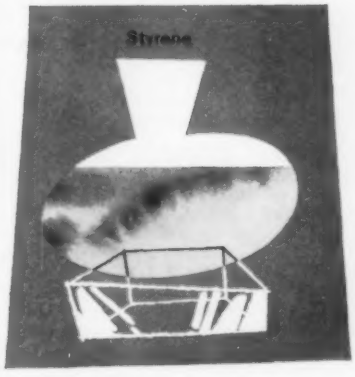

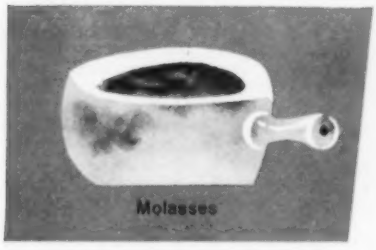

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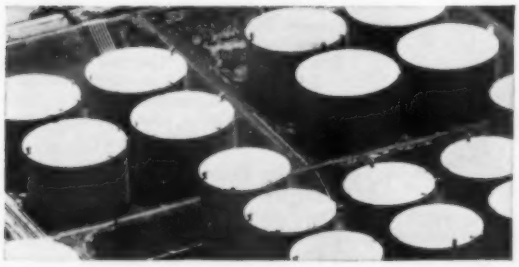

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THE JOURNAL'S 1957 . . .

SURVEY OF PETROCHEMICAL PLANTS

Organics • Nitrogen Chemicals • Butadiene and Copolymer • Sulfur Conversion • Carbon Black • Canada

1. ORGANICS—U. S.

A

ALLIED CHEMICAL & DYE CORP., Barrett Div., Frankford, Pa.
Raw material: Propane-propylene blend.
Principal products: Phenol; acetone.

ALLIED CHEMICAL & DYE CORP., National Aniline Div., Buffalo, N. Y.
Raw material: Kerosine fraction; white-oil fraction.
Principal products: Alkyl aryl sulfonates (water soluble); long-chain alkyl aryl sulfonates (oil soluble); dodecylbenzene.

ALLIED CHEMICAL & DYE CORP., Nitrogen Div., Orange, Tex.
Raw material: Ethylene.
Principal products: Ethylene glycol; ethylene oxide; ethanolamines.

ALLIED CHEMICAL & DYE CORP., Semet-Solvay Div., Buffalo, N. Y.
Raw material: Ethylene (from residual-oil fraction).
Principal products: Polyethylene resin pipe compound; high-melting-point polyethylene wax.
Construction: Will increase capacity of polyethylene resin pipe compound by end of 1957.

ALLIED CHEMICAL & DYE CORP., Solvay Products Div., Moundsville, W. Va.
Raw material: Methane (natural gas).
Principal products: Methyl chloride; methylene chloride; chloroform; carbon tetrachloride.

ALOX CORP., Niagara Falls, N. Y.
Raw material: Petroleum fractions.
Principal products: Oxygenated petroleum chemicals for rust preventives, lube-oil additives, mixtures of organic acids, and other oxygenated hydrocarbons.

AMERICAN CYANAMID CO. (Fortier plant), Avondale, La.
Raw material; Natural gas.
Principal products: Ammonia; hydrocyanic acid, acrylonitrile; ammonium sulfate; monomethyl styrene; acetylene (used internally).
Construction: Will double capacity for hydrocyanic acid, acetylene, acrylonitrile by mid-1958. Facilities for acrylonitrile derivatives are planned.

AMERICAN CYANAMID CO., Warners, N. J.
Raw material: Petroleum fractions.
Principal products: Oil-layer type of petroleum sulfonate (barium salt).

AMERICAN CYANAMID CO., Escambia Bay near Pensacola, Fla.
Construction: Will complete acrylic fiber facilities mid-1958.

AMERICAN OIL CO., El Dorado, Ark.
Raw material: Refinery streams.
Principal products: Propylene tetramer; polybutenes.

AMERICAN OIL CO., Destrehan, La.
Raw material: Refinery streams.
Principal products: Polybutenes.

AMOCO CHEMICALS CORP. (formerly Hidalgo Chemical Co.), Brownsville, Tex.
Raw material: Natural gas.
Principal products: Aldehydes; ketones; alcohols; organic acids.

AMOCO CHEMICALS CORP. (formerly Pan American Chemicals Corp.), Texas City, Tex.
Raw materials: Petroleum fractions; refinery gases.
Principal products: Benzene-2°; toluene; xylenes; hydrocarbon resins (petroleum polymer and condensation resins); aromatic solvents; drying oils; alkylated naphthalenes; nonene; methyl mercaptan.

AMOCO CHEMICALS CORP., Joliet, Ill.
Construction: Will complete July 1958, a 60,000,000-lb. aromatic oxidation plant to produce phthalic anhydride; isophthalic acid; terephthalic acid, dimethyl terephthalate; dimethyl isophthalate; benzoic acid.

ATLANTIC REFINING CO., Philadelphia.
Raw material: Crude petroleum fractions; refinery gases; solvent extracts.
Principal products: Aromatic solvents; crude carbolates; crude cresylic acid; technical eicosane; nonene; crude mercaptans; alkylbenzene; dodecylbenzenesulfonic acid type of water-soluble alkyl aryl sulfonates.
Raw material: Asphalt.
Principal product: Thermoplastic resin.

ATLANTIC REFINING CO., Atreco, Tex.
Raw material: Petroleum fractions; refinery gases; solvent extracts.
Principal products: Detergent alkylate (from benzene and propylene tetramer); diisobutylene and triisobutylene.

ATLAS PROCESSING CO., Shreveport, La.
Raw material: Naphtha (400° F., e.p.) from natural-gas extraction.
Principal product: Benzene.

B

BARIUM REDUCTION CORP., South Charleston, W. Va.
Raw material: Natural gas.
Principal products: Carbon disulfide; hydrogen sulfide.

BRIN CHEMIALS, Tulsa.
Raw materials: Refinery-waste caustic-treating solution.
Principal products: Acid oils (phenols, cresols, xylenols).

C

CALCASIEU CHEMICAL CORP. (Cities Service, Continental Oil Co., Mineral Industries, Inc., Sears, Roebuck & Co.), Lake Charles, La.
Construction: Will complete facilities to produce 8,000,000 gal. per year of ethylene oxide and ethylene glycol, February 1958. Cost is $10,000,000. Petroleum Chemicals, Inc., will operate plant.

CALIFORNIA-SPRAY CHEMICAL CORP. (Subsidiary Standard Oil Co. of California), Richmond, Calif.
Raw material: Petroleum bases.
Principal products: Summer and winter oil sprays; aromatic solvents; spray detergents; emulsifiers.

CELANESE CORP. OF AMERICA, Bishop, Tex.
Raw material: Natural gas; liquefied petroleum gases (propane, butanes).
Principal products: Propylene oxide; propylene glycol; dipropylene glycol; 1,3-butylene glycol; 2,3-butylene glycol; acetone; methanol; formaldehyde; formaldehyde solutions in alcohols; paraformaldehyde; trioxane; acetaldehyde; acetic acid; n-propanol; isobutanol; n-butyl alcohol; special solvents; n-proply acetate; pentaerythritol; 3-methoxy butanol; butyraldehyde; 2-ethyl butanol; hexylene glycol; crotonaldehyde.
Construction: Will complete a trimethylal propane unit late 1957.

CELANESE CORP. OF AMERICA, Pampa, Tex.
Raw material: Natural gas; liquefied petroleum gases (propane, butanes).
Principal products: Propionic acid; methanol; acetone; acetic acid; acetic anhydride; vinyl acetate; n-proply acetate; n-butyl acetate; butyric acid; methyl acetone; acetate methylal; methyl ethyl ketone; ethyl acetate.
Construction: Will complete last quarter of 1957, a 15,000,000-lb. per year acrylate ester unit.

CELANESE CORP. OF AMERICA, Point Pleasant, W. Va.
Raw material: Petroleum cresylic acid, phenol; propyl alcohol; ethylene oxide; butyl alcohol; isooctyl alcohol, pentaerythritol.
Principal products: Tricresyl phosphate; dialkyl phosphate; polyester plasticizers; phenyl dicresyl phosphate; chlorinated phosphates; pentaerythritol esters; flame resistant hydraulic fluid.

CELANESE CORP. OF AMERICA, Houston.
Raw material: Ethylene and alpha olefins.
Principal product: Low-pressure polyolefin (40,000,000 lb. per year).

CHEMSTRAND CORP. (Monsanto Chemical Co., American Viscose Corp.), Decatur, Ala.
Raw material: Acrylonitrile.
Principal products: Acrylic fibers (30,000,000 lb. per year).

SURVEY OF PETROCHEMICAL PLANTS

Construction: Will expand capacity 15,000,000 lb. per year by mid-1958.

CHEMSTRAND CORP., Pensacola, Fla.
Raw material: Petroleum-base stocks.
Principal product: Nylon (90,000,000 lb. per year).
Construction: Will expand capacity to 114,000,000 lb. per year by mid-1958.

COLUMBIA GAS SYSTEMS, Inc., Kenova, W. Va.
To build $13 million hydrocarbon extraction facilities; fractionation plant at Siloam, Ky.
Product: Hydrocarbons as petrochemical raw materials.

COLUMBIA-SOUTHERN CHEMICAL CORP. Subsidiary of Pittsburgh Plate Glass Co.), Natrium, W. Va.
Raw material: Benzene.
Principal products: Monochlorobenzene; ortho-dichlorobenzene; para-dichlorobenzene; benzene hexachloride.

COLUMBIA-SOUTHERN CHEMICAL CORP., Barberton, Ohio.
Raw material: Propane.
Principal product: Perchloroethylene.

COMMERCIAL SOLVENTS CORP., Sterlington, La.
Raw material: Hydrogen; carbon monoxide.
Principal product: Methanol.
Raw material: Natural-gas fractions.
Principal products: Nitroethane; nitromethane; 1-nitropropane; 2-nitropropane; nitrobutane.
Construction: Will complete an $8,000,000 expansion of methanol and petrochemical derivatives fall of 1957. (See also under "Columbia Gas Systems, Inc." considering Ohio Valley ethylene plant as joint venture).

CONTINENTAL OIL CO., Baltimore.
Raw material: Propylene tetramer; benzene.
Principal products: Alkyl aryl sulfonating stocks including dodecylbenzene.

CONTINENTAL OIL CO. (Stepan Chemical), Chicago.
Raw material: Dodecylbenzene.
Principal products: Water-soluble surface-active sulfonates including liquid, slurried, drum-dried, and spray-dried stocks (dodecylbenzenesulfonic acid type); oil-formation-fracturing compounds.

CONTINENTAL OIL CO., Ponca City, Okla.
Raw material: Naphtha fraction; propylene.
Principal products: Benzene; toluene; propylene tetramer.

CONTINENTAL OIL CO., (Sherwood Refining Div.), Gretna, La.
Raw material: Lube oil stocks.
Principal products: Natural sulfonates.

CONTINENTAL OIL CO., Lake Charles, La.
Raw material: Naphtha fraction.
Principal products: Benzene; toluene.
Raw material. Propylene.
Principal product: Propylene tetramer.

CONTINENTAL OIL CO., Trainer, Pa.
Raw material: Alkyl-aryl sulfonating feed stock.
Principal products: Oil-soluble surface-active sulfonates (lubricating-oil detergent additive, fuel-oil additives).

COSDEN PETROLEUM CORP., Big Spring, Tex.
Raw material: Naphtha fractions.
Principal products: Benzene; toluene; xylene; ethylbenzene; styrene monomer.
Raw material: Mixed olefins.
Principal product: Polybutene (1,300,000 gal. per year).
Raw material: Aromatic naphtha.
Principal product: Petroleum resin.
Raw material: Caustic-treating solutions.
Principal products: Ethyl; propyl; butyl mercaptans (odorants).

CROWN CENTRAL PETROLEUM CORP., Pasadena, Tex.
(Propane-propylene stream sold to Shell Chemical Corp.)

D

DELHI-TAYLOR OIL CORP., Corpus Christi. Tex.
Raw material: Naphtha fraction.
Principal products: Benzene; toluene; xylenes (5,000 bbl. per day).

DIAMOND ALKALI CO. (Deer Park plant), Pasadena, Tex.
Raw material: Ethylene.
Principal products: Perchloroethylene; vinyl chloride; polyvinyl chloride.
Construction: Will build a $10,000,000, 40-ton per day acetylene plant starting fall 1957. A 50,000,000-lb. per year vinyl chloride monomer unit will be completed early 1958.

DIAMOND ALKALI CO. (Greens Bayou plant), Pasadena, Tex.
Raw material: Benzene.
Principal products: Benzene hexachloride; DDT.
Construction: DDT capacity is being expanded.

DOW CHEMICAL CO. (Consolidated with Velasco, Tex.), Freeport, Tex.
Raw material: Natural gas; liquefied petroleum gases; benzene.
Principal products: Ethylene diamine; mono-di, -tri, -ethanolamines; glycerin; ethylene and propylene oxides; ethylene, -propylene, -diethylene, -dipropylene, -tetraethylene, -triethylene, -and tripropylene-glycols; carbon tetrachloride; chloroform; dichloroethyl, -and dichloroisopropyl ether; styrene, ethyl benzene; ethyl, -methyl, -and methylene chlorides; vinyl- and vinylidene chlorides; ethylene, -ethylidene, -and propylene dichlorides; methyl chloroform; perchloroethylene; butadiene, styrene-butadiene latex; polyethylene; trichloroethylene.
Construction: Will complete first quarter 1959 an acrylonitrile plant.
Construction: Ethylene oxide and glycol and triethylene glycol capacities will be expanded by March 1958.

DOW CHEMICAL CO., Midland, Mich.
Raw material: Crude oil; natural gas.
Principal products: Ethylene; propylene; styrene; butadiene; methyl styrene; ethylene glycol; ethyl benzene; ethyl chloride; ethylene dibromide; diethylbenzene; polystyrene; divinylbenzene; ethylene dichloride; ethylene oxide; mono-, di-, -and triethanolamines; ethylene diamine; i-propylbenzene (cumene); i-propyl chloride; propylene oxide; propylene dichloride; i-propanolamines; toluene 2°; polyglycols; glycol ethers; styrene-butadiene latex; saran; polyvinyl chloride; vinyltoluene.

DOW CHEMICAL CO., Pittsburg, Calif.
Raw material: Natural gas.
Principal products: Methylene chloride; methyl chloride; chloroform; carbon tetrachloride; perchloroethylene.

DOW CHEMICAL Co.
Plants at Torrance, Calif., Allyn's Point, Conn., Pevely, Mo.; and Ironton, Ohio; as well as Midland, Mich.
Dow also is constructing new synthetic fiber plant at Lee Hall, Va.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Plaquemine La.
Construction: Will complete in 1958, a $50,000,000 plant to produce ethylene, propylene, glycols, vinyl chloride and other chlorinated hydrocarbons and related products from liquid petroleum gas and brine.

DOW CHEMICAL CO., Bay City, Mich.
Construction: Will complete in 1958, facilities to produce ethylene and butadiene from refinery streams.

E. I. DU PONT DE NEMOURS & CO., Orange, Tex.
Raw material: Natural gas; propane; benzene; cyclohexane; adiponitrile.
Principal products: Methanol; polyethylene; nylon intermediates; (adipic acid; hexamethylene-diamine). Ethylene made from natural gas and/or propane is used internally.
Construction: Increasing high-pressure polyethylene, and increasing methanol capacity by 30,000,000 gal. per year.

E. I. DU PONT DE NEMOURS & CO., La Porte, Tex.
Raw material: Methanol.
Principal products: Carbamate fungicides; methylamines; dimethyl formamide.

E. I. DU PONT DE NEMOURS & CO., Victoria, Tex.
Raw material: Natural gas; butadiene.
Principal product: Adiponitrile (nylon salt basic).

E. I. DU PONT DE NEMOURS & CO., Memphis, Tenn.
Raw material: Natural gas.
Principal products: Hydrogen cyanide; sodium cyanide.

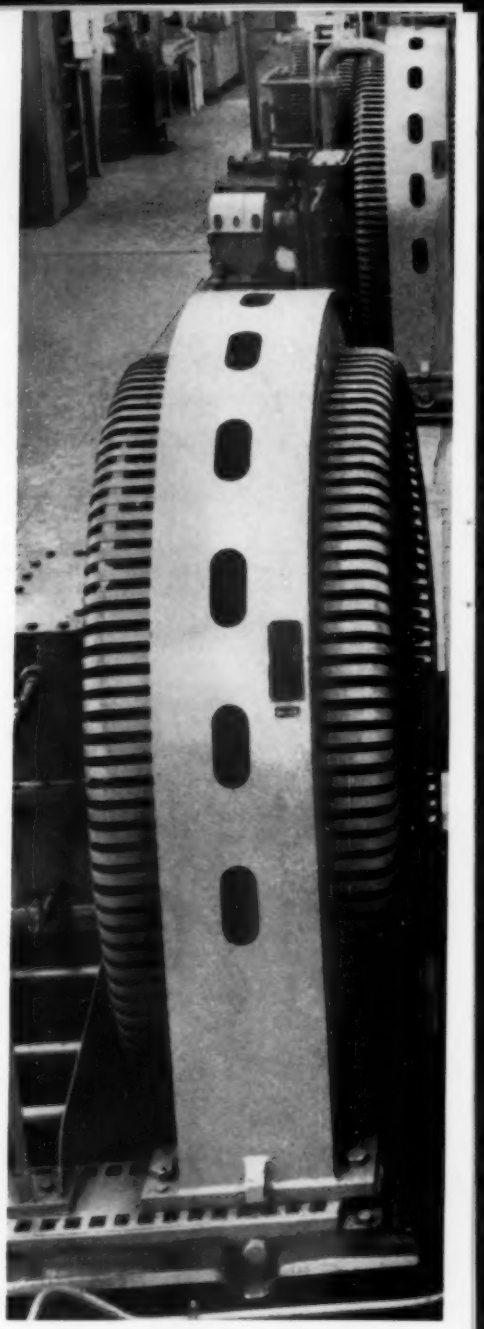
E. I. DU PONT DE NEMOURS & CO., Antioch, Calif.
Raw material: Petroleum base stock.
Principal products: Tetraethyl lead; fluorinated hydrocarbons.

E. I. DU PONT DE NEMOURS & CO., Beaumont, Tex.
Raw material: Ethylene.
Principal product: Chlorosulfonated polyethylene synthetic rubber, methiomine.

D-X SUNRAY OIL CO., Duncan, Okla.
Raw material: Refinery gases.
Principal product: Propylene tetramer.

E

EASTERN STATES CHEMICAL CORP.



Cooper-Bessemer 2-cylinder FM's compressing ammonia at the Tuscola plant of U. S. Industrial Chemical.

In Ammonia Service for U.S.I....

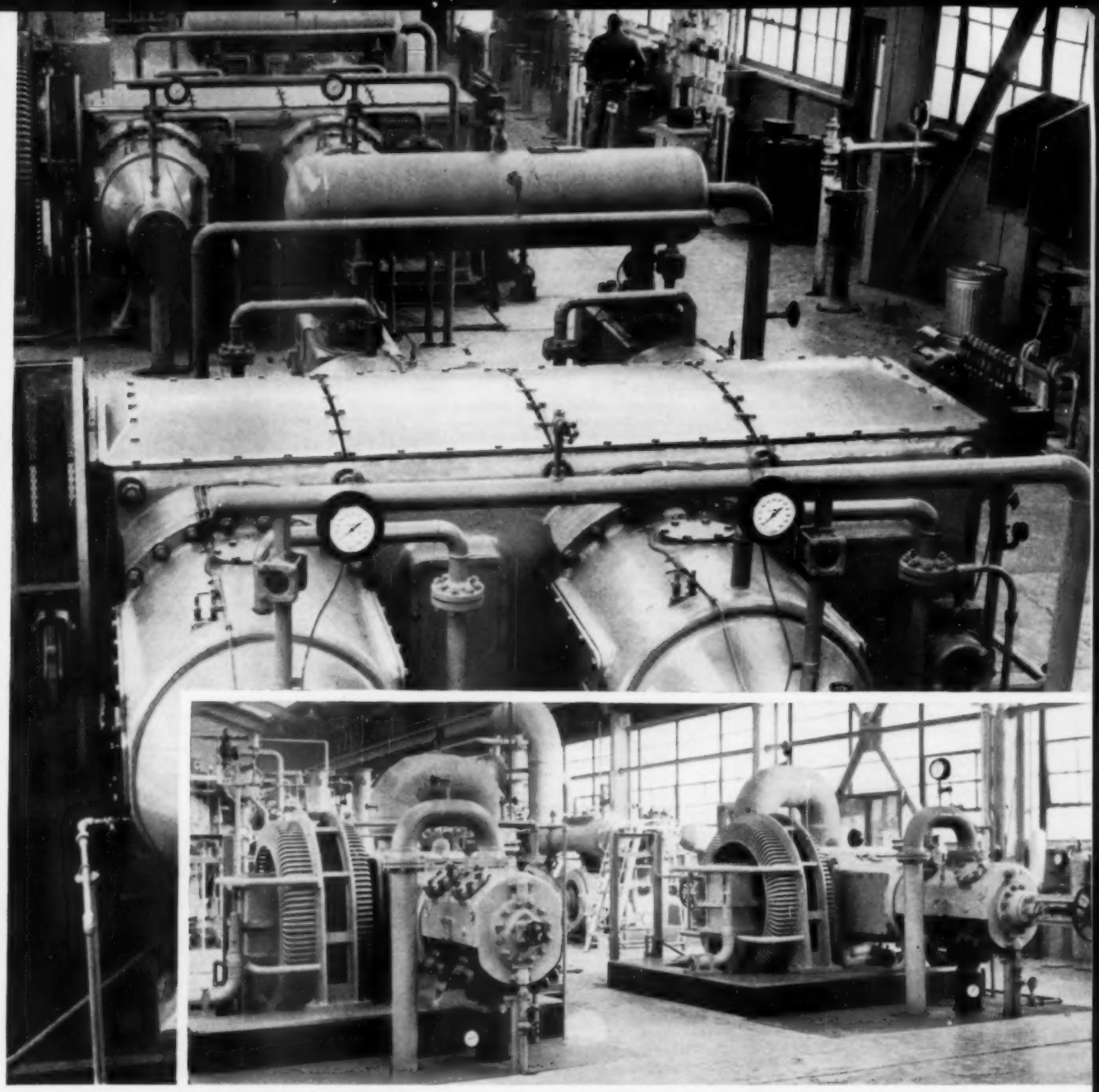
high efficiency Cooper-Bessemer Compressors

This installation at the Tuscola, Illinois plant of U. S. Industrial Chemical Co., a division of National Distillers and Chemical Corp., is typical of the many processing plants using reliable Cooper-Bessemer compressors.

Here, two 4-cylinder JM compressors, each rated 1500 hp, handle compression of synthesis gas; and two 2-cylinder FM compressors, each rated 300 hp, handle the compression of ammonia.

These modern, natural force balance Cooper-Bessemers retain the long-life qualities of much larger slow speed units. The M-Line is exceptionally compact without sacrificing accessibility or ruggedness. They conserve valuable space, reduce over-all installation time, and require less investment in foundations and piping.

Available from 200 to 6000 horsepower, each M-Line compressor unit is engineered to meet specific requirements with extreme efficiency and at the lowest possible cost. The nearest Cooper-Bessemer office will gladly furnish detailed information.



Two 1500 hp motor-driven JM compressors handling compression of synthesis gas, before conversion to ammonia.

Cooper/Bessemer

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SURVEY OF PETROCHEMICAL PLANTS

and EASTERN STATES PETROLEUM CO., INC., Houston.
Raw material: Naphtha fractions.
Principal products: Benzene-2°; various aromatic solvents.
Raw material: Refinery streams.
Principal products: 1-butene; 2-butene and mixtures; isobutylene; isobutane; isopentane.

ESCAMBIA CHEMICAL CORP., Pensacola, Fla.
Raw material: Natural gas.
Principal products: Methanol; polyvinyl chloride (30,000,000 lb. per year).
Construction: Will complete a 16,000,000-gal. per year methanol plant first quarter 1958.

ESSO STANDARD OIL CO., Baton Rouge, La.
Raw material: Natural gas; refinery gas streams; liquid fractions.
Principal products: Aromatic distillates and solvents; aromatic tars; ethane and ethylene; propane and propylene; 1, 3-butadiene; isobutylene; isoprene; tripropylene; ethanol; isopropanol; isooctanol; decanol; tridecanol; ethyl ether; isopropyl ether; dicyclopentadiene; benzene; butyl rubber (47,000 long tons per year); tetrapropylene; acetone (from isopropyl alcohols); petroleum resins; normal butylene.
Construction: Building a $12,000,000 ethylene-recovery unit (part of a $40,000,000 expansion program).

ESSO STANDARD OIL CO., Linden, N. J.
Raw material: Refinery gas streams; liquid fractions.
Principal products: Ethylene; naphthenic acids; isobutylene; polyisobutylenes; isopropanol; sec.-butanol; isopropyl acetate; sec.-dibutyl acetate; methyl ethyl ketone; acetone; isopropyl ether; lube oil additives.
Construction: Will complete early 1958, a plant to include ethylene recovery and manufacture by pyrolysis.

ETHYL CORP., Baton Rouge, La.
Raw material: Ethane; ethylene.
Principal products: Tetraethyl lead; ethyl chloride; ethylene dichloride.
Construction: Vinyl chloride facilities will be completed late 1957.

ETHYL CORP., Pasadena, Tex.
Raw material: Ethylene.
Principal products: Tetraethyl lead; ethyl chloride; ethylene dichloride.

ETHYL CORP., Pittsburg, Calif.
Construction: Will complete a TEL plant mid-1958.

ETHYL-DOW CHEMICAL CO., INC., Freeport, Tex.
Raw material: Ethylene.
Principal product: Ethylene dibromide.

F

FIRESTONE PLASTIC CO. (Div. of Firestone Tire & Rubber Co.), Pottstown, Pa.
Raw material: Petroleum-base stocks.
Principal products: Polybutadiene-acrylonitrile type (N-type) acrylic elastomers; polybutadiene-styrene type acrylic elastomers; vinyl resins.

FOOD MACHINERY & CHEMICAL CORP., South Charleston, W. Va.
Raw material: Methane (natural gas).
Principal product: Carbon tetrachloride.
Construction: Will double capacity of carbon tetrachloride by early 1958.

FOSTER GRANT CO., INC., Baton Rouge, La.
Raw material: Benzene; ethylene.
Principal product: Styrene (2,000,000 lb. per month).
Company also operates polystyrene plant at Leominster, Mass.

FRONTIER OIL REFINING CO. (Division of Ashland Oil & Refining Co.), North Tonawanda, N. Y.
Construction: Will complete in early 1958, a $3,250,000 catalytic reformate plant to produce benzene (4,500,000 gal. per year); toluene, xylenes, and heavy aromatics (12,000,000 gal. per year).

G

GENERAL ANILINE & FILM, Linden, N. J.
Raw material: Ethylene.
Principal products: Ethylene oxide; ethylene glycol.
Construction: Building an $8 million, 60,000,000-lb. per year ethylene oxide and 35,000,000-lb. per year ethylene glycol plant.

GENERAL PETROLEUM CORP., Torrance, Calif.
Raw material: Refinery streams.
Principal product: Sodium cresylate sludge; crude naphthenic acids; ammonium sulfate; hydrogen sulfide (in commercial amine solution).

GENERAL PETROLEUM CORP., Ferndale, Wash.
Raw material: Refinery streams.
Principal product: Sodium sulfide sludge.

GENERAL TIRE & RUBBER CO., Mogadore, Ohio.
Raw material: Petroleum-derived material.
Principal product: Polybutadiene-styrene-vinylpyridine type acrylic elastomers.

GENERAL TIRE & RUBBER CO., Ashtabula, Ohio.
Raw material: Acetylene.
Principal product: Polyvinyl chloride.

GENERAL TIRE & RUBBER CO., Akron.
Raw material: Petroleum-base stocks.
Principal product: Polybutadiene-acrylonitrile (N-type) acrylic elastomers.

GOODRICH, B. F., CHEMICAL CO., Calvert City, Ky.
Raw material: Petroleum-derived stocks.
Principal product: Special rubbers, including acrylonitrile-butadiene, brominated butyl, carboxylic nitrile, liquid G.R.-S., butadiene-styrene, and polyacrylic rubber.

GOODRICH, B. F., CHEMICAL CO., Akron, Ohio.
Raw material: Petroleum-derived stocks.
Principal products: Butadiene-acrylonitrile (N-type); acrylic rubber.

GOODRICH, B. F., CHEMICAL CO., Avon Lake, Ohio.
Raw material: Alcohols; vinyl chloride.
Principal products: Plasticizers; polyvinyl chloride resins and compounds.

GOODRICH, B. F., CHEMICAL CO., Louisville, Ky.
Raw material: Petroleum-derived stocks.
Principal products: Butadiene-acrylonitrile rubbers; other rubbers.

GOODRICH-GULF CHEMICALS, INC., Orange, Tex.
Construction: A polyethylene plant is being built.

GOODYEAR TIRE & RUBBER CO., Chemical Division, Akron, Ohio.
Raw material: Petroleum-base stocks.
Principal products: Butadiene acrylonitrile (N-type) elastomers (rubber and latices); high-styrene type of resins (paint bases, rubber reinforcers; molding resins); styrenated products; butadiene-styrene elastomers (rubbers and latices); vinyl chloride polymers (resins and latices).
(Goodyear also makes vinyl chloride polymers; alkyl and aryl organic-rubber-processing chemicals; and butadiene-styrene and butadiene-acrylonitrile rubbers and resins at other plants).

GRACE, W. R., & CO., Baton Rouge. La.
Raw material: Ethylene.
Principal product: Polyethylene.

GREAT SOUTHERN CHEMICAL CORP. (Pontiac Refining Corp., La Gloria Oil & Gas Corp., Gulf Oil Corp.), Corpus Christi, Tex.
Raw material: Naphtha fractions.
Principal products: Benzene, toluene; xylenes.

GULF OIL CORP., Port Arthur, Tex.
Raw material: Refinery gases; heptene; other refinery streams.
Principal products: Ethylene (1,000,000 lb. daily); isooctyl alcohol; butylenes; light isooctyl alcohol; octyl polymer; aromatic distillate.
Constrruction: Plan new facilities for benzene manufacture.

H

HAWTHORNE CHEMICAL CORP. (Hercules Powder Co. and Imperial Chemical Industries, Ltd.), Louisiana, Mo.
Raw material: Amonia; methanol; acetone.
Principal product. Methyl methacrylate.
Construction: Building facilities for formaldehyde, pentaerithrytol, and methanol at a cost of $6,000,000. An $11 million, 35,000,000-lb. per year monomethyl methacrylate and polymer plant will be completed late 1958.

HERCULES POWDER CO., Louisiana, Mo.
Raw material: Natural gas.
Principal products: Methanol (70 tons daily); formaldehyde (100,000,000 lb. per year); pentaerythritol (24,000,000 lb. per year).

HERCULES POWDER CO., Gibbstown, N. J.
Raw material: Propylene; benzene.
Principal products: Phenol, acetone, cumene; cumene hydroperoxide; acetophenone; a-methylstyrene.

HERCULES POWDER CO., Parlin, N. J.
Raw material: Ethylene.
Principal product: Polyethylene (Ziegler process, 30,000,000 lb. per year).

HEYDEN CHEMICAL CORP., Texas City, Tex.

(Part owner with Monsanto in methanol plant—see under "Monsanto").

HOOKER ELECTROCHEMICAL CO., Niagara Falls, N. Y.
Raw material: Pentane; petroleum waxes.
Principal products: Chlorinated waxes; hexachlorocyclopentadiene.

HUMBLE OIL & REFINING CO., Baytown, Tex.
Raw material: Refinery streams.
Principal products: Toluene; solvent xylene; para-xylene; aromatic qcench oil; high boiling aromatic solvents; narrow-boiling range aliphatic naphthas (hexane, heptane, octane); special naphthas; cyclohexane; tetrapropylene; tripropylene; normal butylenes; isobutylene; propylene concentrate; butadiene; butyl rubber; carbon black feed stock.
Construction: Will complete a benzene unit (30,000,000 gal. per year) last quarter 1957. Will complete a catalytic light ends recovery and ethylene unit (80,000,000-lb. per year) third quarter 1958. Capacity of ethylene unit will be doubled later.

I

INDEX CHEMICAL CO., (Subsidiary of Pennsalt Chemicals Co.), Houston.
Raw material: Natural gas; butane; methyl alcohol; ethyl alcohol.
Principal products: Methyl mercaptan; ethyl mercaptan; thiophene.

J

JEFFERSON CHEMICAL CO., INC., Port Neches, Tex.
Raw material: Refinery gases (ethane, propane streams); propylene polymer; phenol.
Principal products: Ethylene oxide; ethylene, diethylene and triethylene glycols; polyethylene glycols; ethanolamines; ethylene carbonate; propylene carbonate; morpholine; nonyl phenol; ethylene oxide-nonyl phenol condensates. (Ethylene made at Port Neches from refinery gases and/or L.P.G. is used internally).
Construction: Has under way a $38,000,000 expansion program: ethylene capacitiy will be 180,000,000 lb. per year; ethylene oxide will be 165,000,000 lb. per year with addition of new direct-oxidation units; ethylene glycol will be 126,000,000 lb. per year; ethylene chloride will be added; chlorine facilities will be built; units for propylene oxide-glycol and other propylene derivatives will be built; ethylene oxide specialties and morpholine will be expanded.

JEFFERSON LAKE SULPHUR CO. (The Merichem Division), Houston.
Raw material: Refinery treating wastes.
Principal products: Phenol; cresols; cresylic acid; sodium sulfide.
Construction: Will increase cresylic acid capacity to 200,000 gal. per month, completion September 1957.

K

KENDALL REFINING CO., Bradford Pa.
Raw material: Petroleum fractions.
Principal products: Heavy hydrocarbons (petroleum polymer and condensation resins).

KOPPERS CO., INC., (Chemical Div.), Port Arthur, Tex.
Raw material: Ethylene.
Principal products: Ethylbenzene; polyethylene.

KOPPERS, CO., INC., (Chemical Div.), Kobuta, Pa.
Raw material: Ethylbenzene.
Principal products: Styrene; polystyrene; polyethylene (Ziegler process).
Construction: Wil complete an expandable polystyrene bead plant aarly 1958.

KOPPERS CO., INC., (Chemical Div.), Woodridge Township, N. J.
Construction: Wil complete 30,000,000-lb. per year low-pressure polyethylene unit January 1, 1958.

L

LEONARD REFINERIES, INC., (Roosevelt Division), Mount Pleasant, Mich.
Raw material: Naphtha fraction.
Principal products: Benzene; toluene.

LUBRIZOL CORP., Pasadena, Tex.
Raw material: Petroleum fractions.
Principal products: Petroleum sulfonates (barium and calcium salts); other lube-oil additives.

LUBRIZOL CORP., Cleveland.
Raw material: Petroleum fractions.
Principal products: Petroleum sulfonate; lube-oil additives.

M

MAGNOLIA PETROLEUM CO., Beaumont, Tex.
Raw material: Petroleum fractions.
Principal products: Cresylic acid; sodium cresylate solutions.

MARBON CHEMICAL (Division of Borg-Warner Corp.), two plants, Gary, Ind.
Raw material: Acrylonitrile; butadiene; styrene.
Principal products: High-styrene resins; high impact thermoplastic molding material.

MARBON CHEMICAL (Division of Borg-Warner Corp.), Parkersburg, W. Va.
Raw material: Styrene; acrylonitrile; butadiene.
Principal product: High-impact thermoplastic resin.

MONSANTO CHEMICAL CO., Avon, Calif.
Raw material: Benzene.
Principal product: Phenol (by sulfonation).

MONSANTO CHEMICAL CO., Texas City, Tex.
Raw material: Natural gas; propane; benzene.
Principal products: Ethylbenzene; styrene; ethylene dichloride; vinyl chloride; acrylonitrile; hydrogen cyanide; toluene-2°; tertiarybutylamine.
Raw material: Ethylene.
Principal product: Polyethylene.
Construction: Will expand acrylonitrile capacity to 100,000,000 lb. per year by end of 1957. (Acetylene from natural gas and ethylene by pyrolysis of L.P.G. used internally).

MONSANTO CHEMICAL CO., (Organic Chemical Division), Luling, La.
Raw material: Petroleum-derived fractions.
Principal product: Nylon intermediate (adipic acid processing).

MONSANTO CHEMICAL CO and HEYDEN CHEMICAL CORP., Texas City, Tex.
Raw material: Byproduct hydrogen; carbon monoxide from acetylene synthesis.
Principal product: Methanol.

MONTROSE CHEMICAL CO., Newark, N. J.
Raw material: Petroleum cresylic acid.
Principal product: Tricresyl phosphate.

N

NATIONAL PETRO-CHEMICALS CORP. (National Distillers and Chemicals Corp., and Panhandle Eastern Pipeline Co.), Tuscola, Ill.
Raw material: Natural gas (ethane); ethylene.
Principal products: Ethanol; ethyl ether; ethyl chloride; polyethylene.

NATURAL GAS ODORIZING, INC., Houston.
Raw material: Crude mercaptans (ethyl and higher).
Principal products: Odorants for natural gas and L.P.G.

NAUGATUCK CHEMICAL CO., Naugatuck, Conn.
Raw material: Styrene; butadiene; acrylonitrile.
Principal product: Styrene copolymers.

NAUGATUCK CHEMICAL, Baton Rouge, La.
Raw material: Styrene; butadiene; acrylonitrile.
Principal products: N-type rubber; styrene copolymers and latices; rubber-resin blends.

NEVILLE CHEMICAL CO., Neville Island, Pa.
Raw material: Unsaturated petroleum fractions.
Principal products: Aromatic petroleum solvents; heat reactive resins; thermoplastic resins.

NEVILLE CHEMICAL CO., Anaheim, Calif.
Raw material: Unsaturated petroleum fractions.
Principal products: Aromatic petroleum solvents; heat-reactive resins; thermoplastic resins.

NINOL LABORATORIES, INC., Chicago.
Raw material: Dodecylbenzene; diethanolamine.
Principal products: Dodecylbenzene sulfonates; alkylolamide detergents.

NOPCO CHEMICAL CO., (Griffin Chemical Div.), Richmond, Calif.
Raw material: Petroleum fractions.
Principal products: Naphthenic acid; petroleum sulfonates (emulsifying agents).

O

ODESSA STYRENE CO. (El Paso Natural Gas Products Co., and United Carbon Co.), Odessa, Tex.
Construction: Will complete a $5,000,000 styrene plant January 1, 1958. Fish Engineering Corp. has contract.

SURVEY OF PETROCHEMICAL PLANTS

OHIO-APEX DIVISION, FOOD MACHINERY & CHEMICAL CO., Nitro, W. Va.
Raw material: Petroleum cresylic acid.
Principal products: Tricresyl phosphate; plasticizers (also diisooctyl phthalate and diallyl phthalate monomer from isooctyl, allyl, and other alcohols).
issoctyl, allyl, and other alcohols).

OLIN-MATHIESON CHEMICAL CORP., Brandenburg, Ky.
Raw material: Natural-gas liquids (ethane).
Principal products: Ethylene oxide; ethylene; diethylene, and triethylene glycols; polyethylene glycols; ethylene dichloride; ethylene glycol ethers; ethanolamines; diechloroethyl ether; aromatic distillates and solvents. Nonionic surface active agents (aliphatic polyoxyethylene ether alcohols); pour-point depressant and V. I. improver for lube oil.

ORONITE CHEMICAL CO., (Standard Oil Co. of Calif. subsidiary), Oak Point, La.
Raw material: Petroleum-base stocks.
Principal products: Lube-oil additives; furnace-oil additive; gas odorants; nonionic detergents; algicides; alkyl phenols; hydraulic fluid; grease additive; diesel fuel additive.
Construction: Asked for $12,000,000 Louisiana state tax exemption to expand plant.

P

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP., Chester, Pa.
Raw material: Petroleum-base stocks.
Principal products: Petroleum polymer; condensation resins.

PENNSYLVANIA REFINING CO., Karns City, Pa.
Raw material: Finished and semifinished lube oil and distillates.
Principal products: Petroleum sulfonates.

PENNSALT CHEMICALS CORP., Wyandotte, Mich.
Raw material: Pentane; pentane fractions; triisobutylene.
Principal products: Amyl alcohol; amyl chloride; amyl acetate; amyl prenols; amyl naphthalenes; n-alkyl mercaptans; tertiary dodecyl mercaptan; tertiary dodecyl thioether; 1 and 2-pentene; mixed pentenes; thiophene.

PETROCARBON CHEMICALS, INC., Irving, Tex.
Raw material: Distillate and crude oil.
Principal products: Aromatic solvents, aliphatic solvents; gasolines; diesel fuel.
Construction: Plan to add a Udex unit to make pure benzene, toluene, and xylenes.

PETROLEUM CHEMICALS, INC. (Cities Service Co. and Continental Oil Co.), Lake Charles, La.
Raw material: Petroleum feed stocks.
Principal products: 1, 3-butadiene; 1-butene; 2-butene and mixtures.
Construction: A 200,000,000-lb. per year ethylene plant will be completed January 1958, designed for expansion to 300,000,000 lb. per year.

PHILLIPS CHEMICAL CO., Pasadena, Tex.
Raw material: Acetaldehyde and ammonia; ethylene.
Principal products: Methylethylpyridine, methylvinylpyridine (3,000,000 lb. per year).
Construction: Will complete a $30,000,-000,75,000,000 lb. per year polyethylene unit by end of 1957.

PHILLIPS CHEMICAL CO., Sweeny, Tex.
Raw material: Butane.
Principal product: Ethylene (180,000,000 lb. per year).

PHILLIPS CHEMICAL CO., (Philtex Experiment Station), Phillips, Tex.
Raw material: Petroleum fractions.
Principal products: Tert-butyl mercaptan; tert-dodecyl mercaptan; other sulfur chemicals; odorless thinners; and other chemical specialties.

PHILLIPS CHEMICAL CO. (operated by Cosden Petroleum Corp.), Big Spring, Tex.
Raw material: Mixed xylene.
Principal product: Para-xylene (3,540,-500 lb. per year).

PHILLIPS PETROLEUM CO., Kansas City, Kans.
Raw material: Petroleum fractions.
Principal products: Rubber extender; process oils.

PHILLIPS PETROLEUM CO., Phillips, Tex.
Raw material: Petroleum fractions.
Principal products: Diisopropyl; cyclohexane; hydrogen sulfide; ethyl mercaptan.

PROCESSORS, INC. and OIL & CHEMICAL PRODUCTS, INC., Galena Park, Tex.
Raw material: Petroleum fractions.
Principal products: Benzene; toluene; xylenes; aromatic solvent naphthas; odorless paint thinners; DDT base.

PRODUCTOL CO., Santa Fe Springs, Calif.
Raw material: Refinery byproduct fractions.
Principal products. Phenols; cresols; cresylic acids.

PURE OIL CO., Smiths Bluff, Tex.
Raw material: Petroleum fractions; refinery gas streams.
Principal products: Petroleum polymer; condensation resins; solvents: nonparaffin concentrates; 1-butene; 2-butene and mixtures.

PURE OIL CO., Toledo, Ohio.
Raw material: Petroleum fractions.
Principal products: Solvents; toluene-2°; xylene (aviation grade); heavy mixed aromatics; polymers.

R

REICHHOLD CHEMICALS, INC., Elizabeth, N. J.
Raw material: Benzene.
Principal product: Maleic anhydride.

REICHHOLD CHEMICALS, INC., Seattle, Wash.
Raw material: Phenol (chlorinated).
Principal product: Pentachlorophenol.

REICHHOLD CHEMICALS, INC., Tacoma, Wash.
Raw material: Phenol (chlorinated).
Principal product: Pentachlorophenol.

REICHHOLD CHEMICALS, INC., Tuscaloosa, Ala.
Raw material: Benzene.
Principal product: Phenol.
Raw material: Formalin-acetaldehyde.
Principal product: Pentaerythritol.
Reichhold also makes formaldehyde from methanol at Ballardvale, Mass.; Charlotte, N. C.; Seattle, Wash.; Tacoma, Wash., and Tuscaloosa, Ala.

REILLY TAR & CHEMICAL CORP., Indianapolis.
Raw material: Petroleum fractions.
Principal products: Phenols; cresols.

REPUBLIC OIL & REFINING CO. (Division of Plymouth Oil Co.), Texas City, Tex.
Raw material: Refinery gas streams.
Principal products: Butane and butylenes; ethylene; propylene tetramer; propylene trimer.
Construction: Engineering a 5,000-bbl. per day Udex unit to produce benzene, toluene, and xylenes.

RICHFIELD OIL CORP., Wilmington, Calif.
Raw material: Petroleum fractions.
Principal product: Naphthenic acids.
Raw material: Refinery cracked gases.
Principal products: Ethylene-ethane stream.

RICHFIELD OIL CORP., Watson, Calif.
Construction: Will complete an 18,000,-000-gal. per year benzene plant May 1958, at a cost of $6,500,000.

ROHM & HAAS CO., Pasadena, Tex.
Raw material: Carbon monoxide; alcohols.
Principal products: Acrylic monomers (methyl and ethyl acrylates).
Raw material: Hydrogen cyanide; acetone.
Principal product: Acetone cyanohydrin.
Construction: Has contracted for Texaco Development-H.R.I. partial oxidation of natural gas to synthesis gas. Will complete late 1957.

S

SHELL CHEMICAL CORP., Houston.
Raw material: Petroleum hydrocarbons (propylene, ethylene, butylenes).
Principal products: Acetone; diacetone alcohol; ethyl alcohol; hexylene glycol; isopropyl alcohol; isopropyl ether; mesityl oxide; methyl ethyl ketone; methyl isobutyl carbinol; methyl isobutyl ketone; sec-butyl alcohol; allyl alcohol; allyl chloride; epichlorohydrin; ethyl chloride; glycerin; epoxy resins (condensation polymers of epichlorohydrin and bisphenol); soil fumigant (chlorinated C_3 hydrocarbons); glycerol dichlorohydrin; trichloropropane; bisphenol-A; glycidyl phenyl ether.

SHELL CHEMICAL CORP., Denver.
Raw material: Petroleum hydrocarbons.
Principal products: Insecticides; agricultural chemicals (aldrin, dieldrin, endrin); nemagon nematocide; methyl parathion.

SHELL CHEMICAL CORP., Norco, La.
Raw material: Petroleum hydrocarbons.
Principal products: Crude chlorohydrins; allyl chloride; soil fumigant.

Mill scale removal by Dowell started this new plant off with a $100,000 operating profit

Here's how the management of a multi-million dollar corporation used its knowledge of chemical cleaning to start a new plant off in the right way—in the black.

Following construction, and before the plant was put on stream, Dowell was called in to remove mill scale from the following systems:

• Ammonia Compressors Suction and Discharge Piping • Engine Water-Cooling System • Engine Oil-Cooling System • Engine Jackets • Hydraulic Oil-Cooling System • Oxygen Suction and Discharge Piping • Miscellaneous Piping • Product Lines to Storage • Miscellaneous Towers

The total cost of this mill scaling was approximately $5,000. But, once in production, this plant did not have a single major shut down for maintenance caused by mill scale. The plant management credits Dowell Service with netting the plant an operating profit somewhere between 10 and 20 times the cost of the chemical cleaning. This amounted to between $50,000 and $100,000 the first year.

This particular case history is about a chemical company, but Dowell has startling performance data to show you—from your own industry. That's because chemical cleaning is so versatile. Dowell engineers are experts in removing scale and sludge from process systems, tanks and piping. They apply solvents in various ways—such as filling, jetting, cascading. Dowell furnishes all the necessary chemicals, trained personnel, pumping and control equipment.

For specific information on how chemical cleaning can help you to greater profits, call the Dowell office near you. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

have Dowell clean it chemically DOWELL

A SUBSIDIARY OF THE DOW CHEMICAL COMPANY

SURVEY OF PETROCHEMICAL PLANTS

Construction: Hydrogen peroxide facilities will be completed late 1957. Alcohol and ketone facilities will be completed fall 1957.

SHELL CHEMICAL CORP., Dominguez, Calif.
Raw material: Petroleum hydrocarbons.
Principal products: Isopropyl alcohol; acetone; methyl ethyl ketone; methyl isobutyl ketone; diacetone alcohol; sec-butyl alcohol; mesityl oxide.

SHELL CHEMICAL CORP., Martinez, Calif.
Raw material: Petroleum hydrocarbons.
Principal products: Isopropyl alcohol; acetone; methyl ethyl ketone; diacetone alcohol; methyl isobutyl ketone; ethyl amyl ketone; sec-butyl alcohol; tert-butyl alcohol; methyl isobutyl carbinol; trisubstituted phenol (2, 6-ditertiary-butyl-4-methyl-phenol—used as antioxidant); p-tert-butylbenzene acid; sodium sulfonates (for lube-oil additives); fuel-oil additive; ethyl amyl ketone.

SHELL OIL CO., Houston.
Raw material: Naphtha fractions.
Principal products: Benzene-2°; toluene-2°
Raw material: Refinery streams.
Principal products: Propane and propylene; 1-butene; 2-butene and mixtures.

SHELL OIL CO., Martinez, Calif.
Raw material: Refinery streams.
Principal products: Cresylic acid; crude naphthenic acids; propane and propylene; 1-butene; 2-butene and mixtures; oil-layer-type petroleum sulfonate (sodium salt).
Construction: Will complete September 1957, facilities to produce mono-, di-, and triallylamines.

SHELL OIL CO., Wilmington, Calif.
Raw material: Refinery streams.
Principal products: Xylene-3°; mixed xylenes; propane and propylene; 1-butene; 2-butene and mixtures; cyclohexane; toluene; cresylic acid.

SHELL OIL CO., Wood River, Ill.
Raw material: Naphtha fractions.
Principal products: Toluene, xylenes.

SHELL OIL CO., Norco, La.
Raw material: Refinery streams.
Principal product: Propylene.

SINCLAIR CHEMICALS, INC., East Chicago, Ind.
Raw material: Petroleum fractions.
Principal products: Antioxidants; aromatic solvents; gear-oil additives; turbine-oil additives; cutting-oil additives; cresylic acids.

SINCLAIR CHEMICALS, INC., Sand Springs, Okla.
Raw material: Petroleum fractions.
Principal products: Demulsifying agents; corrosion inhibitors; acid-layer-type petroleum sulfonate (sodium salt); oil-layer-type petroleum sulfonate (sodium salt).

SINCLAIR CHEMICALS, INC., Marcus Hook, Pa.
Raw material: Petroleum streams.
Principal products: Dodecene; cresylic acids.
Raw material: Catalytic reformate
Principal products: Aromatic hydrocarbons (toluene, p-xylene, xylene solvents, heavy aromatic solvents).

SINCLAIR CHEMICALS, INC., Houston.
Raw material: Petroleum fractions.
Principal products: Oil-layer type of petroleum sulfonates (barium, calcium, sodium salts); corrosion inhibitors; isoparaffinic ordorless solvents; cresylic acids.
Construction: Expanding SO_3 sulfonation and lube-oil synthetic detergents additives.

SINCLAIR CHEMICALS, INC., Corpus Christi. Tex.
Raw material: Petroleum fractions.
Principal products: Aromatic solvents.

SINCLAIR CHEMICALS, INC., Hartford, Ill.
Raw material: Petroleum fractions.
Principal products: Aromatic solvents.

SINCLAIR CHEMICALS, INC., Wellsville, N. Y.
Raw material: Petroleum fractions.
Principal products: Petroleum resins.

SOCONY MOBIL OIL CO., INC., Paulsboro, N. J.
Raw material: Petroleum fractions.
Principal products: Sodium cresylate solutions; sodium sulfide solutions; propylene.

SOCONY MOBIL OIL CO., INC., East Chicago, Ind.
Raw material: Refinery streams.
Principal products: Sodium cresylate solutions; hydrogen.

SOCONY MOBIL OIL CO., INC., East St. Louis, Ill.
Raw material: Refinery streams.
Principal products: Sodium cresylate solutions.

SOCONY MOBIL OIL CO., INC., Buffalo.
Raw material: Petroleum fractions.
Principal products: Sodium sulfide solutions; sodium cresylate solutions.

SOCONY MOBIL OIL CO., INC., Brooklyn.
Raw material: Petroleum fractions.
Principal products: Sodium cresylate solutions.

SONNEBORN, L., SONS, INC., (Daugherty Refinery, Petrolia, Pa.
Raw material: Petroleum fractions.
Principal products: Oil-layer type of petroleum sulfonate (sodium salt); water-soluble petroleum sulfonate.

SPENCER CHEMICAL CO., Henderson. Ky.
Construction: Will complete fall 1957, a polymer plant to convert caprolactam to nylon-6 molding resins.

SPENCER CHEMICAL CO., Orange, Tex.
Raw material: Ethylene.
Principal product: Polyethylene.
Construction: Will complete polyethylene expansion to 90,000,000 lb. per year by summer 1958.

STANDARD OIL CO. OF CALIFORNIA, El Segundo, Calif.
Raw material: Petroleum-base stocks.
Principal products: Benzene; toluene; paraxylene; cumene; butadiene-butylene mixtures.

STANDARD OIL CO. OF CALIFORNIA, Richmond, Calif.
Raw material: Petroleum-base stocks; natural gas.
Principal products: Orthoxylene; metaxylene; paraxylene; industrial xylenes; alkyl aromatic detergents in various forms; metallic naphthenates; naphthenic acids; cresylic acids; petroleum sulfonates; polybutenes; gas odorants; ethyl mercaptans; isophthalic acid; phthalic anhydride; phenol; acetone; benzoic-toluic acid.
Construction: Will complete a $3,000,000, 52,000,000-lb. per year xylene plant in early 1958. A $1,750,000 polybutene expansion program is being planned.

STANDARD OIL CO. (Ind.), Wood River, Ill.
Raw material: Heptane heartcut from olefin feed.
Principal products: Isooctyl; decyl or higher alcohols.
Raw material: Petroleum fractions.
Principal products: Polybutene and high-molecular-weight hydrocarbons; sodium cresylate; lube-oil detergent and corrosion inhibitor additives; petroleum-base plasticizers; gasoline and distillate fuel additives.

STANDARD OIL CO. (Ind.), Sugar Creek, Mo.
Raw material: Petroleum fractions.
Principal products: C_3 olefin concentrate; sodium cresylate.

STANDARD OIL CO. (Ind.), Whiting, Ind.
Raw material: Petroleum fractions.
Principal products: Benzene-1°; solvent grade toluene and xylenes; acid-layer-type petroleum sulfonate; detergent alkylate; sodium cresylate.

STAUFFER CHEMICAL CO., Louisville, Ky.
Raw material: Propane; propylene; natural gas.
Principal products: Carbon tetrachloride; perchlorethylene; chloroform; methylene chloride.

STAUFFER CHEMICAL CO., Le Moyne, Ala.
Raw material: Natural gas.
Principal product: Carbon disulfide.
Stauffer also makes sulfuric acid from hydrogen sulfide and sludge acid at Dominguez, Calif.; Baton Rouge, La.; Houston, Tex.; and Baytown, Tex.

STAUFFER CHEMICAL CO, Ashtabula, Ohio.
Construction: Will complete in 1957 a multimillion dollar plant to produce carbon tetrachloride, chloroform, methylene chloride, and anhydrous ammonia.

SUN OIL CO., Marcus Hook, Pa.
Raw material: Refinery streams.
Principal products: Petroleum sulfonates; naphthenic acids; propylene tetramer (dodecene); propylene timer (nonene); benzene; toluene; xylene.

SUN OIL CO., Toledo.

Raw material: Refinery streams.
Principal products: Butylenes; propylene tetramer (dodecene); hydrogen.

SUNTIDE REFINING CO., Corpus Christi, Tex.
Raw material: Propylene.
Principal product: Tetramer (150,000 bbl. per year).
Raw material: Naphtha.
Principal products: Benzene (140,000 bbl. per year); toluene (315,000 bbl. per year); xylene (440,000 bbl. per year).

T

TENNESSEE EASTMAN CO. (Division of Eastman Kodak Co.), Kingsport, Tenn.
Raw material: Ethanol; isobutyraldehyde; normal-butyraldehyde; isobutyl alcohol; 2-ethylhexyl alcohol; 2-ethyl isohexanol; polyethylene; neopentyl glycol; isopropyl alcohol; nonyl alcohol.
Principal products: Acetic and butyric acids and anhydrides; acetaldehyde; acetanilide; n-butyl acetate; crotonaldehyde; dibutyl phthalate; diethyl phthalate; di-2-ethylhexyl phthalate; di-2-ethylhexyl adipate; di-isobutyl adipate; di-2-ethylhexyl sebacate; di-isobutyl phthalate; ethyl acetate; isobutyl acetate; isopropyl acetate; triethyl phosphate; acetone; polymeric plasticizer; dinonyl phthalate; 2-ethyl hexoic acid; polyethylene plastics; polyethylene waxes.
Raw material: Acetic and butyric acids and anhydrides.
Principal products: Cellulose acetate and cellulose acetate butyrate.
Raw material: Cellulose esters.
Principal products: Cellulose acetate textile fibers; acetate and butyrate plastics; plasticizers.

TEXAS BUTADIENE & CHEMICAL CORP., Houston.
Raw material: N-butane; isobutane; isopentane; natural gasoline.
Principal products: Butadiene; chemical-grade butylenes.

TEXAS CO., THE, Port Arthur, Tex.
Raw material: Refinery fractions.
Principal products: Naphthenic acid; oil-layer type of petroleum sulfonates; ethane-ethylene stream; propane-propylene mixture; 1-butene; 2-butene and mixtures; heavy hydrocarbons; olefin polymers; diisobutylene; rust inhibitors; gasoline additives; lubricating oil additives.

TEXAS EASTMAN CO. (Division of Eastman Kodak Co.), Longview, Tex.
Raw material: Propane; natural gas.
Principal products: Ethanol; isobutyraldehyde; normal-butyraldehyde; isobutyl alcohol; isobutyronitrile; polyethylene (55,000,000 lb. per year); 2-ethylhexyl alcohol; 2-ethyl isohexanol; neopentyl glycol.
Construction: Oxo facilities being expanded to increase butyraldehydes and higher aldehydes capacity.

THOMPSON CHEMICAL CO., Attleboro, Mass.
Raw material: Vinyl chloride monomer.
Principal product: Polyvinyl chloride resin.

U

UNION CARBIDE CHEMICALS CO., South Charleston, W. Va.
Raw material: Natural gas; refinery gases; crude oil; other petroleum fractionss.
Principal products: Alcohols; butadiene; esters; ketones; glycol-ethers; plasticizers such as dioctyl phthalate and others; glycols such as ethylene-, di-and-triethylene glycols and others; polyethylene plastic; synthetic lubricants; oxides (ethylene and propylene oxides) and acetales; aldehydes; organic acids; anhydrides; nitrogen compounds such as acetonitrile, amines (mono-di-and-triethanol amines, morpholine and other amines); chlorine compounds such as ethylene dichloride, ethylene and propylene chlorhydrin, etc.; aryl chemicals such as acetoacetanilide, 2-methyl-5-ethyl pyridine, etc.; surface active agents (ionics and anionics).

UNION CARBIDE CHEMICALS CO., Institute, W. Va.
Raw material: Natural gas; other petroleum streams.
Principal products: Acetaldehyde; acetic acid; acetic anhydride; acetone; acetonitrile; acetophenone; acrolein; acrylonitrile; n-butyl alcohol; butyric acid; butyric anhydride; diethylene glycol; diisobutyl ketone; 2-ethylbutanol; ethylene glycol; ethylene oxide; 2-ethylhexanol; n-hexanol; isophorone; isopropanol; aleic anhydride mesityl oxide; methyl acetone; 2-methyl-5-ethyl pyridine; methyl isobutyl ketone; paraldehyde; plasticizers; alpha-picoline; gamma-picoline; polyethylene glycols; propionic anhydride; trimethyl nonanone-4.
Construction: Will double production of acrylonitrile in 1958.

UNION CARBIDE CHEMICALS CO., Texas City, Tex.
Raw material: Natural gas; refinery gases (ethane, propane).
Principal products: Acetaldehyde, acetic acid; acetic anhydride; acetone; 2-aminoethyl ethanolamine; butadiene; n-butyl acetate; n-butyl alcohol; diethylene glycol; diethylene triamine; ethanol; ethyl acetate; ethylene diamine; ethylene dichloride; ethylene glycol; ethylene oxide; isobutanol; isopropanol; isopropyl; acetate; methanol; methyl acetone; methyl isobutyl ketone; polyethlene; tetraethylene pentamine; trichlorethane; triethylene tetramine; vinyl acetate; vinyl chloride; other vinyl resins and vinyl plastic materials. (Acetylene made from natural gas and ethylene made from natural gas and/or refinery gases, ethane, propane are used internally).

UNION CARBIDE CHEMICALS CO., Whiting, Ind.
Raw material: Refinery gases.
Principal products: Acetic anhydride; acetone; ethanol; ethylene oxide and ethylene glycol; isopropanol; methyl ethyl ketone; methyl isobutyl ketone.

UNION CARBIDE CHEMICALS CO., Torrance, Calif.
Raw material: Refinery cracked gases (ethylene).
Principal products: Polyethylene; ethylene oxide and ethylene glycol.

UNION CARBIDE CHEMICALS CO., Seadrift, Tex.
Raw material: Natural gas (ethane).
Principal products: Butadiene; polyethylene; ethylene oxide and ethylene glycol.

UNION CARBIDE CHEMICALS CO., Niagara Falls, N. Y.
Raw material: Acetylene.
Principal products: Vinyl esters; acetic acid hydroxyethyl cellulose.

UNION CARBIDE CORP., (Bakelite Co., Div.), Marietta, Ohio.
Raw material: Petroleum-derived stocks.
Principal products: Styrene plastics; phenol.

UNION CARBIDE CHEMICAL CO., Putnam, W. Va.
Construction: Will complete by 1960 a $50 million, 150,000,000-lb. per year ethylene and propylene plant. Ethanol, ethylene oxide and isopropanol will be included in the chemicals to be made. Plant will be designed for greatest possible flexibilitiy to meet changes in market demands.

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif.
Raw material: Refinery gases and wastes.
Principal products: Methyl, ethyl mercaptans (500,000 lb. per year).

U. S. INDUSTRIAL CHEMICALS CO., Tuscola, Ill.
Raw material: Butadiene.
Principal product: Dibasic acid (mixture of isomers of sebacic acid).

UNIVERSAL DETERGENTS, INC., Long Beach, Calif.
Raw material: Petroleum fractions.
Principal products: Alkyl aryl sulfonates; aromatic solvents.

V

VELSICOL CHEMICAL CORP., Marshall, Ill.
Raw material: Petroleum-base stocks.
Principal products: Benzene-1°; benzene-motor grade; toluenes; xylenes; high-boiling aromatic petroleum solvents; petroleum-derived formulation solvents; hydrocarbon polymers and resins.

VICKERS PETROLEUM CO., INC., Potwin, Kans.
Construction: Will complete a $2,000,000 U.O.P. Udex unit to produce 15,000,000 gal. per year of benzene, toluene, xylene, and aromatics in January 1958.

VISCO PRODUCTS CO., INC., Sugarland, Tex.
Raw material: Petroleum fractions; petroleum chemicals.
Principal products: Crude-oil desalting and dehydrating chemicals; special oxyalkylated compounds.

VISCO PRODUCTS CO., INC., Anaheim, Calif.
Raw material: Petroleum fractions; petroleum chemicals.
Principal products: Crude-oil desalting and dehydrating chemicals.

W

WARREN PETROLEUM CORP., Conroe, Tex.

Raw material: Liquefied petroleum gas (propane, butane).
Principal products: Pentaerythritol; methanol, acetaldehyde.

WITCO CHEMICAL CO., Chicago.
Raw material: Petroleum naphthenic acid.
Principal products: Metallic naphthenates (paint drying agents and lube additives).
Raw material: Petroleum wax.
Principal products: Sun checking inhibitors (rubber compounding).
Raw material: Asphalt fractions.
Principal products: Rubber extenders; saturating compounds; insulating mastics.

WITCO CHEMICAL CO., Perth Amboy, N. J.
Raw material: Solid petroleum tar; heavy-liquid and semisolid petroleum fractions.
Principal products: Rubber extenders; extending plasticizer; rubber softeners; sun checking inhibitors; insulating compounds.

WITCO CHEMICAL CO., Lawrenceville, Ill.
Raw material: Solid petroleum tar; heavy-liquid and semisolid petroleum fractions.
Principal products: Rubber extenders; extending plasticizers; rubber softeners; sun checking inhibitors; insulating compounds.

WITCO CHEMICAL CO., Los Angeles.
Raw material: Naphthenic acids.
Principal products: Metallic naphthenates.

WYANDOTTE CHEMICALS CORP., Michigan Alkali Division, Wyanotte, Mich.
Raw materials: Petroleum fractions and derivatives.
Principal products: Alkyl aryl sulfonates; ethylene glycol; diethylene glycol; ethylene dichloride; polyoxyalkylene compounds; chloroethers; aromatic distillates and solvents (chlorinated solvents).
Construction: Will complete late 1957, an oxide products plant to produce polyethers (nonionic surfactants).

WYANDOTTE CHEMICALS CORP., Michigan Alkali Division, Geismar, La.
Construction: Will complete $8,000,000, 60,000,000-lb. per year ethylene oxide-glycol plant fall 1957. A $20,000,000, electrolytic chlorine-caustic plant will be completed last half of 1958.

2. NITROGEN-CHEMICAL MANUFACTURE—U. S.

A

ALLIED CHEMICAL & DYE CORP., Nitrogen Division, South Point, Ohio.
Raw material: Natural gas.
Principal products: Ammonia (725 tons per day); urea; nitrogen solutions; high-analysis mixed fertilizer; methanol; formaldehyde; urea-formaldehyde concentrate.

ALLIED CHEMICAL & DYE CORP., Nitrogen Division, Hopewell, Va.
Raw material: Natural gas.
Principal products: Ammonia (935 tons per day); ammonium nitrate-limestone; pebbled ammonium nitrate; nitrogen solutions; sodium nitrate; nitrogen tetroxide.

ALLIED CHEMICAL & DYE CORP., Nitrogen Division, La Platte, Neb.
Raw material: Natural gas.
Principal products: Ammonia (210 tons per day); urea; nitrogen solutions.

AMERICAN CYANAMID CO., (Fortier plant), Avondale, La.
Raw material: Natural gas.
Principal products: Ammonia (300 tons per day); ammonium sulfate.

AMMONIA CHEMICAL CORP OF CALIFORNIA and MONTEREY OIL CO., Huron, Calif.
Construction: Will complete February 1958, a $5,000,000 anhydrous ammonia plant using 5 M.M.c.f.d. of natural gas as feed.

APACHE POWDER CO., Curtis. Ariz.
Construction: Will complete a $1,000,000 ammonia synthetic plant by late 1957.

ATLANTIC REFINING CO., Philadelphia, Pa.
Raw material: Byproduct hydrogen from catalytic reformer.
Principal product: Ammonia (165 tons per day).

B

BREA CHEMICALS, INC., (subsidiary Union Oil Co of California), Brea, Calif.
Raw material: Natural gas.
Principal products: Ammonia (300 tons per day); dry ice and liquid CO_2 (70 tons per day); ammonium nitrate; ammonium phosphate.

C

CALIFORNIA-SPRAY CHEMICAL CORP., (subsidiary of Standard Oil Co. of Calif.), Richmond, Calif.
Raw material: Natural and refinery gases.
Principal products: Ammonia (300 tons per day); nitric acid (250 tons per day); ammonium sulfate; ammonium nitrate; fertilizer solutions.

CALUMET NITROGEN PRODUCTS CO. (operated by Standard Oil Co. (Ind.), Hammond, Ind.
Raw material: Natural gas.
Principal products: Anhydrous ammonia and solutions (300 tons per day).

COMMERCIAL SOLVENTS CORP., Sterlington, La.
Raw material: Natural gas.
Principal products: Ammonia (400 tons per day); ammonium nitrate; nitrogen solutions.

COOPERATIVE FARM CHEMICALS ASSOCIATION, Lawrence, Kans.
Raw material: Natural gas.
Principal products: Ammonia (180 tons per day); ammonium nitrate and nitrogen solutions.

D

DEERE & CO. (Grand River Chemical Division), Pryor, Okla.
Raw material: Natural gas.
Principal products: Ammonia (180 tons per day); urea; nitrogen solutions.

E

E. I. DU PONT DE NEMOURS & CO., Belle, W. Va.
Construction: Converting ammonia synthesis from coke oven gas to natural gas.

ESCAMBIA CHEMICAL CORP., Pensacola, Fla.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); ammonium nitrate; nitrogen fertilizer solutions.

G

GENERAL PETROLEUM CORP., Torrance, Calif.
Raw material: Refinery stream
Principal product: Ammonium sulfate

GONZALES CHEMICAL INDUSTRIES, INC., Guanica, P. R.
Has completed a $13,000,000 ammonia plant to produce 42,000 long tons per year of anhydrous ammonia, and 125,000 tons per year of amonium sulfate.

GRACE CHEMICAL CO. (Division of W. R. Grace & Co.) Woodstock, Tenn.
Raw material: Natural gas.
Principal products Ammonia 250 tons daily) urea (150 tons daily).

H

HERCULES POWDER CO., Hercules, Calif.
Raw material: Natural gas.
Principal product: Amonia (150 tons per day).

HERCULES POWDER CO., Louisiana Mo.
Raw material: Natural gas.
Principal product: Amonia (115 tons per day).

M

MISSISSIPPI CHEMICAL CORP., Yazoo City, Miss.
Raw material: Natural gas.
Principal products: Ammonia (280 tons per day); ammonium nitrate.
Construction: Will complete 150-ton per day expansion of nitric acid capacity March 1958.

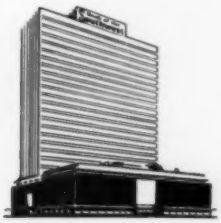
MISSISSIPPI RIVER CHEMICAL CO., Crystal City, Mo.
Raw material: Natural gas.
Principal products: Amonia (200 tons per day); nitric acid (240 tons per day); ammonium nitrate (200 tons per day); ammonia solutions.

MONSANTO CHEMICAL CO., (Inorganic Chemical Division), El Dorado, Ark.

147,000,000 GALLONS OF BUTANE AND PROPANE

147,000,000 gallons of Butane and Propane were produced during the past 12 months in plants financed by Bank of the Southwest. We also finance oil production, drilling rigs, construction of pipelines and gas gathering systems. It will be a pleasure to serve you.

Harold Vance, Vice President and Manager, Oil & Gas Department



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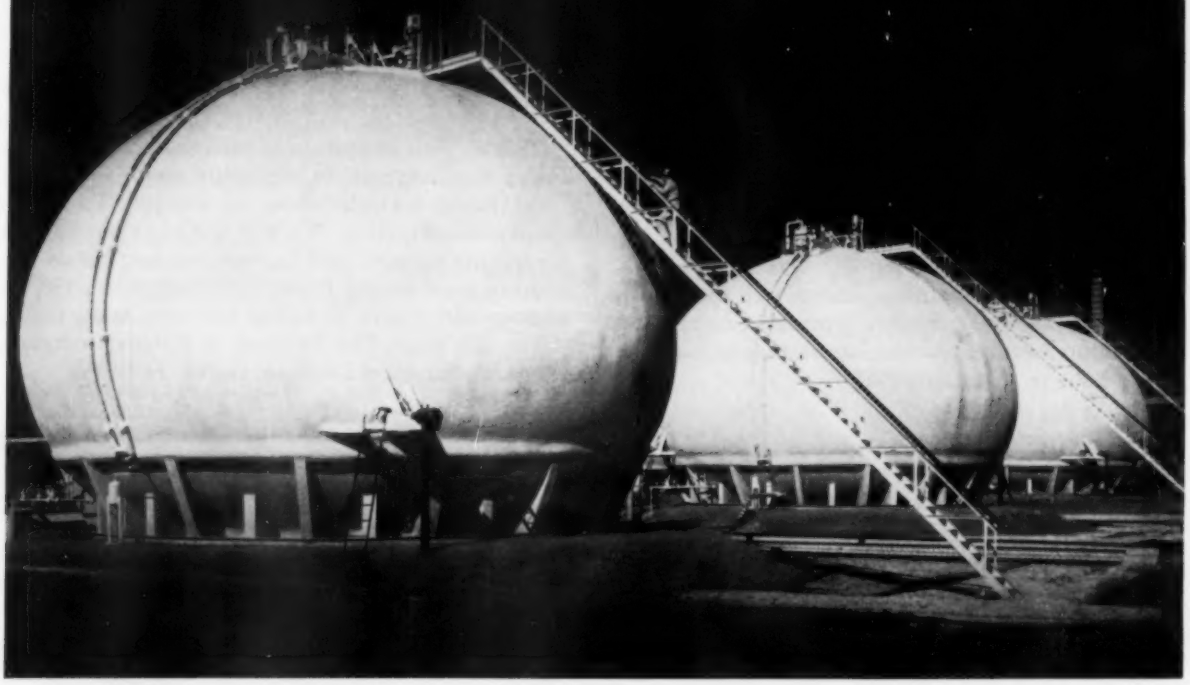

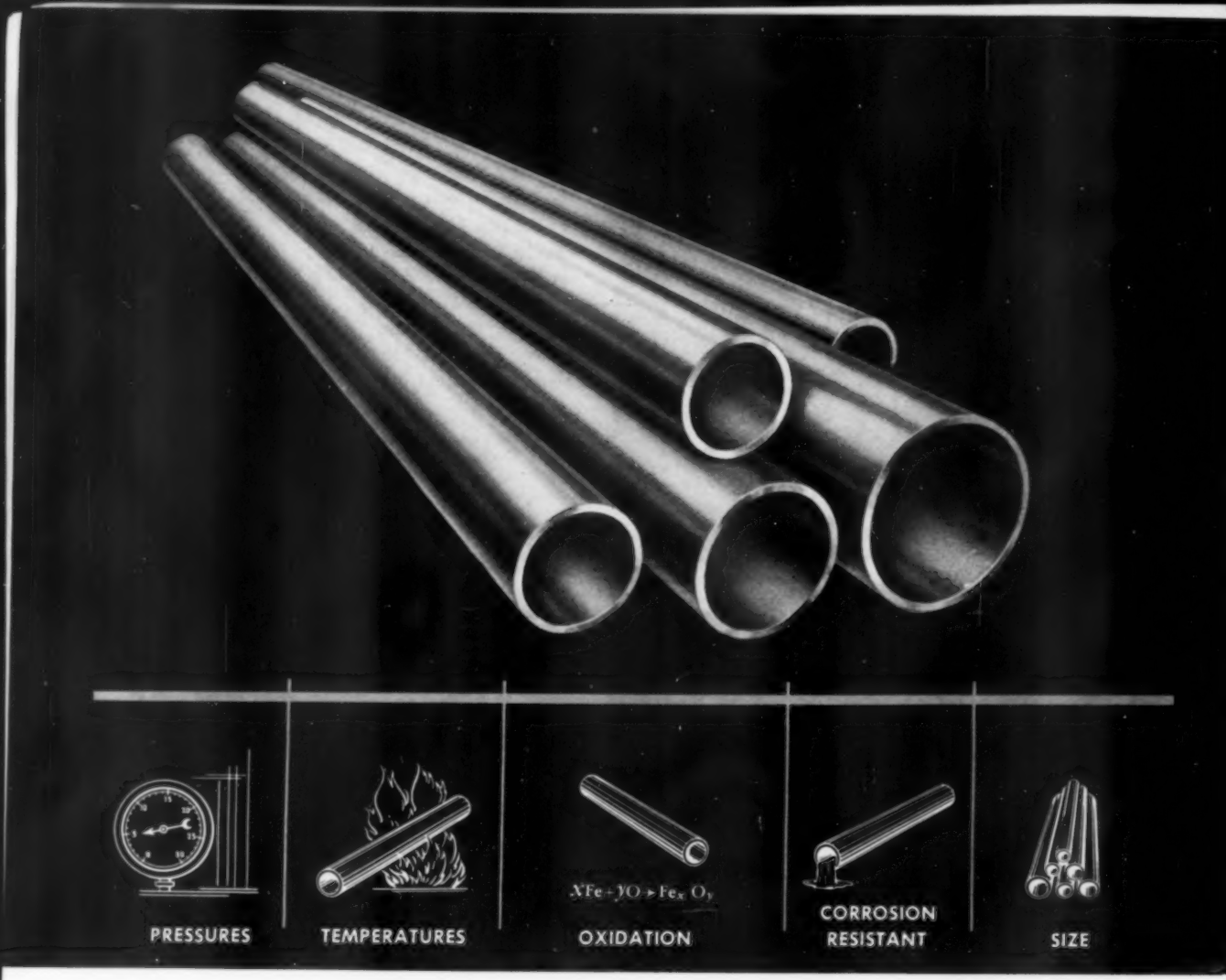

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Pressures, temperatures, oxidation, corrosion resistance, and tube size are important factors the design engineer must consider in specifying tubing for process equipment applications.

For example, one company was faced with a serious problem. Stainless tubing used for conveying methanol and unreacted synthesis gases at 300F and 5000 psi through chloride-bearing bayou water failed due to stress corrosion.

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The new tubing provided the desired resistance to the particular type of corrosion and satisfactorily met all temperature and pressure requirements. What's more, the new installation proved to be substantially lower in materials costs.

B&W, with its years of experience in all phases of tube requirements, is especially qualified to help you choose the right tubing for any job. To get the most benefit from B&W's long experience in matching tubes to jobs in every respect, call on Mr. Tubes, your nearby B&W Tube Representative. He has helped others, as he can help you, make tubing selection *surer*. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-7010-PP4

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels

Raw material: Natural gas.
Principal products: Ammonia (585 tons per day); amonium nitrate; ammonium sulfate; nitrogen solutions; aqua ammonia.

MONSANTO CHEMICAL CO., (Inorganic Chemicals Division), Luling, La.
Raw material: Natural gas.
Principal products: Ammonia (400 tons per day); ammonium nitrate; solid (dry ice) and liquid CO_2 (42 tons per day).

N

NORTHERN CHEMICALS INDUSTRIES, Searsport, Me.
Raw material: Bunker C fuel oil
Principal products: Ammonia (125 tons per day); nitrogen solutions.

O

OLIN MATHIESON CHEMICAL CORP., Lake Charles, La.
Raw material: Natural gas.
Principal products: Ammonia (250 tons per day); hydrazine.

P

PETROLEUM CHEMICALS, INC. (Cities Service Co. and Continental Oil Co.), Lake Charles, La.
Construction: Will complete October 1957, a 100,000-ton per year anhydrous ammonia plant. Cost will be $12,500,000.

PHILLIPS CHEMICAL CO., Pasadena, Tex.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (191,600 short tons per year).
Raw material: Ammonia; sulfuric acid.
Principal product: Ammonium sulfate (365,000 short tons per year).

PHILLIPS CHEMICAL CO., Etter, Tex. (Anhydrous ammonia and nitric acid facilities are government leased).
Raw material: Natural gas.
Principal products: Anhydrous ammonia (191,600 short tons per year); ammonium nitrate (142,000 short tons per year); nitrogen solutions (55,000 short tons per year).

PHILLIPS PACIFIC CHEMICAL CO., (Phillips Petroleum Co. and Pacific Northwest Pipeline Corp. Plant is operated by Phillips Chemical Co.), Kennewick, Wash.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (73,000 short tons per year).

S

SAN JACINTO CHEMICAL CO. (Division of Smith-Douglas Co., Inc.), Houston.
Raw material: Natural gas.
Principal products: Anhydrous ammonia (40,000 tons per year); high analysis fertilizers (20,000 tons per year).
Construction: Will complete September 1957, moving fertilizer manufacturing and storage facilities to Texas City, Tex.

SHELL CHEMICAL CORP., Ventura, Calif.
Raw material: Natural gas.
Principal products: Ammonia (150 tons per day); urea (100 tons per day).

SHELL CHEMICAL CORP., Shell Point (Pittsburg), Calif.
Raw material: Natural gas.
Principal products: Ammonia (330 tons per day); ammonium sulfate.

SOUTHERN NITROGEN CO., INC., Savannah, Ga.
Raw material: Natural gas.
Principal products: Anhydrous ammonia (275 tons per day); nitrogen solutions; prilled ammonium nitrate; urea.

SPENCER CHEMICAL CO., Calumet City, Ill.
Raw material: Methanol and ammonia.
Principal products: Formaldehyde and hexamine hexamethylene tetramine); aqua ammonia.

SPENCER CHEMICAL CO., Pittsburg, Kans.
Raw material: Natural gas (hydrogen and carbon monoxide).
Principal products: Methanol; ammonia (200 tons per day); nitric acid; aqua ammonia; ammoniating solutions; ammonium nitrate; dry ice.

SPENCER CHEMICAL CO., Henderson, Ky.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day); nitric acid; amonia solutions; aqua ammonia.

SPENCER CHEMICAL CO., Vicksburg, Miss.
Raw aterial: Natural gas.
Principal products: Amonia (200 tons per day); nitric acid; amonia solutions; urea.

SPENCER CHEMICAL CO., Fort Worth, Tex.
Raw material: Natural gas.
Principal products: Dry ice and liquid CO_2.

STANDARD OIL CO. (Ohio), Lima, Ohio. (Manufacturer is Sohio Petroleum Co., a subsidiary).
Raw material: Natural gas; refinery off-gas.
Principal products: Anhydrous ammonia (300 tons per day); nitric acid; urea; carbon dioxide (liquid and solid); ammonium nitrate; nitrogen solutions.

ST. PAUL AMMONIA PRODUCTS CO., Pine Bend, Minn.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day) and ammonium nitrate solutions.

SUN OIL CO., Marcus Hook, Pa.
Raw material: Hydrogen from cat reformer.
Principal product: Ammonia (300 tons per day).

T

TENNESSEE VALLEY AUTHORITY, Wilson Dam, Ala. (Noncommercial plant owned and operated by the Government).
Raw material: Natural gas.
Principal product: Ammonia (250 tons per day).

TEXAS CO., THE, Lockport, Ill.
Construction: Will complete a 180-ton per day ammonia plant, part of which will be converted to nitrogen solutions, by late 1957.

U

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif.
Raw material: Refinery gases and wastes.
Principal product: Ammonium sulfate.

U. S. INDUSTRIAL CHEMICALS CO., (Subsidiary of National Distillers & Chemical Corp.), Tuscola, Ill.
Raw material: Natural gas.
Principal products: Ammonia (165 tons per day); ammonium nitrate.

OTHER AMMONIA PLANTS

(Hydrogen from coke oven and coke water gas).

Ketona Chemical Co. (Hercules and Alabama Byproducts), Ketona, Ala.. 125 per day; **Olin Mathieson Corp.,** Morgantown, W. Va., 570 tons per day (reported converting to coal gasification-partial oxidation); U. S. Steel, Geneva, Utah, 200 tons per day.

(Hydrogen from chlorine cells)

Columbia-Southern Chemical Co., Natrum, W. Va., 75 tons per day; **Dow Chemical Co.,** Pittsburg, Calif., 20 tons per day—Freeport, Tex., 230 tons per day—Midland, Mich., 100 tons per day; **E. I. du Pont de Nemours & Co.,** Niagara Falls, N. Y., 30 tons per day; **Hooker Electrochemical Co.,** Tacoma, Wash., 60 tons per day; **Olin Mathieson Corp.,** Lake Charles, La.. 60 tons per day—Niagara Falls, N. Y., 20 tons per day; **Pennsalt Chemicals Corp.,** Wyandotte, Mich.. 95 tons per day—Portland, Ore., 20 tons per day; **Westvaco Chlor-Alkali Div.** (Food Machinery & Chemical Corp.), Charleston, W. Va., 60 tons per day.

3. BUTADIENE AND COPOLYMER—U. S.

(Additional companies making N-type rubbers and other elastomers are listed in Table 1).

COPOLYMER (GR-S) PLANTS

AMERICAN SYNTHETIC RUBBER CORP., Louisville, Ky.
Capacity: 68,500 long tons per year.

COPOLYMER RUBBER & CHEMICAL CORP., Baton Rouge, La.
Capacity: 68,800 long tons per year.
Construction: Will complete a $3,000,000 steam power plant by end of 1958.

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex Division, Akron, Ohio.

Capacity: 40,000 long tons per year.

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber Latex Division, Lake Charles, La.
Capacity: 190,000 long tons per year.

GENERAL TIRE & RUBBER CO., Odessa, Tex.
Capacity: 40,000 long tons per year.

GOODRICH-GULF CHEMICALS, INC., Port Neches, Tex.
Capacity: 90,000 long tons per year.
Construction: Capacity is being expanded by phases as adjoining butadiene plant is expanded.

GOODRICH-GULF CHEMICALS. INC., Institute, W. Va.
Capacity: 122,000 long tons per year.
Construction: A 4-year expansion and modernization program is planned.

GOODYEAR TIRE & RUBBER CO., Akron.
Capacity: 15,200 long tons per year.

GOODYEAR TIRE & RUBBER CO., Houston.
Capacity: 220,000 long tons per pear.

NAUGATUCK CHEMICAL (Division of United States Rubber Co.), Naugatuck, Conn.
Capacity 30,000 long tons per year.

PHILLIPS CHEMICAL CO., Borger, Tex.
Capacity: 108,000 long tons per year.

SHELL CHEMICAL CORP., Torrance, Calif.
Capacity: 110,000 long tons per year.

TEXAS-U. S. CHEMICAL CO., Port Neches, Tex.
Capacity :127,000 long tons per year.
Construction: Expanding capacity stepwise.

UNITED CARBON, INC., Baytown, Tex.
Capacity: 50,000 long tons per year.

BUTYL RUBBER (GR-I) PLANTS

ESSO STANDARD OIL CO., Baton Rouge, La.
Capacity: 47,000 long tons per year.

HUMBLE OIL & REFINING CO., Baytown, Tex.
Capacity: 44,500 long tons per year.
Construction: Will complete expansion of butyl rubber capacity by 13,000 long tons per year first quarter 1958.

PETROLEUM CHEMICALS, INC., Lake Charles, La.
Construction: Will complete a $17,000,000, 30,000-ton per year butyl rubber plant late 1958.

BUTADIENE PLANTS—PETROLEUM

ALLIED CHEMICAL & DYE CORP., Tonawanda, N. Y.
Capacity: 4,000 short tons per year (estimated); butadiene is ethylene cracking byproduct.

COPOLYMER RUBBER & CHEMICAL CORP., Baton Rouge, La.
Capacity: 35,000 short tons per year.

DOW CHEMICAL CO., Midland, Mich. and Freeport, Tex.
Total capacity is 17,400 short tons per year; butadiene is ethylene cracking byproduct. (Also adding new ethylene unit at Bay City, Mich).

ESSO STANDARD OIL CO., Baton Rouge, La.
Capacity 50,000 short tons per year.

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex Division, Orange, Tex.
Capacity: 4 0,000 short tons per year.

HUMBLE OIL & REFINING CO., Baytown, Tex.
Capacity: 65,000 short tons per year.

NECHES BUTANE PRODUCTS CO. (Goodrich-Gulf and Texas-U.S. Chemical), Port Neches, Tex.
Capacity: 190,000 short tons per year.
Construction: Will complete expansion 110,000 short tons per year by fall 1958.

ODESSA BUTADIENE CO. (El Paso Natural Gas Co., Odessa Natural Gas Co., United Carbon, Inc., General Tire & Rubber), Odessa, Tex.
Capacity: 50,000 tons per year.

PETROLEUM CHEMICALS, INC., Lake Charles, La.
Capacity: 80,000 tons per year.

PETRO-TEX CHEMICAL CORP, Houston.
Capacity: 200,000 tons per year.

PHILLIPS CHEMICAL CORP., Borger, Tex.
Capacity: 112,000 short tons per year.

SHELL CHEMICAL CORP., Torrance. Calif.
Capacity: 70,000 tons per year.

STANDARD OIL CO. OF CALIFORNIA, El Segundo, Calif.
Capacity: (Butadiene-butylene mixtures) 16,000 tons per year butadiene; 1,870 bbl. per day butylene.

TEXAS BUTADIENE & CHEMICAL CORP., Houston.
Capacity: Basic butadiene capacity is 65,000 short tons per year. (Butadiene can be increased to 85,000 depending on amount of alkylate and aviation gasoline also made at this plant).

UNION CARBIDE CHEMICAL CO., South Charleston, W. Va.; Texas City, Tex., and Seadrift, Tex.
Total capacity: 35,000 short tons per year (estimated); butadiene is ethylene cracking byproduct.

4. SULFUR CONVERSION—U. S.

FROM SOUR NATURAL GAS

COLUMBIAN CARBON CO., Seminole, Tex.
Capacity: 15.4 tons per day.

GULF OIL CORP., Crane County, Tex.
Capacity: 20 tons daily.

JEFFERSON LAKE SULFUR CO., Needville, Tex.

MONSANTO CHEMICAL CO., Lion Oil Division, Magnolia, Ark.

MONTANA SULFUR & CHEMICAL CO., East Billings, Mont.
Capacity: 40 tons per day.

OLIN MATHIESON CHEMICAL CORP., Magnolia, Ark.

OLIN MATHIESON CHEMICAL CORP., McKamie, Ark.

PAN AMERICAN PETROLEUM CORP., (formerly Stanolind Oil & Gas Co.), Midland Farms, Tex.
Capacity: 11 tons per day.

PAN AMERICAN PETROLEUM CORP., North Cowden (Odessa), Tex.
Capacity: 17 tons per day.

PAN AMERICAN PETROLEUM CORP., Sundown, Tex.
Capacity: 42 tons per day.

PAN AMERICAN PETROLEUM CORP., Elk Basin, Wyo.
Capacity: 65 tons per day.

PHILLIPS CHEMICAL CO., Goldsmith and Crane Counties, Tex.
Capacity: 73,000 long tons per year, (total capacity—two plants).

RICHARDSON GASOLINE CO., SID, Kermit, Tex.
Capacity: 10 tons per day.

RICHARDSON GASOLINE CO., SID, Odessa, Tex.
Capacity: 10 tons per day.

SEABOARD OIL CO., Silver Tip Field, Wyo.
Capacity: 60 long tons per day.

TEXAS GULF SULFUR CO., Worland, Wyo.

WARREN PETROLEUM CORP., Monument, N. M.

WESTVACO CHLOR-ALKALI DIVISION, South Charleston, W. Va.
Construction: Expanding its plant.

FROM REFINERY GAS

(Includes also sulfuric acid plants as noted)

ALLIED CHEMICAL & DYE CORP., General Chemical Division, El Segundo, Calif.
(Refinery gases to sulfuric acid).

ALLIED CHEMICAL & DYE CORP., General Chemical Division, Richmond, Calif.
(Refinery gases to sulfuric acid).

ATLANTIC REFINING CO., Philadelphia.

CONSOLIDATED CHEMICAL INDUSTRIES, INC., (Div. of Stauffer Chemical Co.), Baton Rouge, La. and Baytown, Tex.
(Refinery sludge acid and sulfur to sulfuric and including facilities for sulfur manufacture from refinery H_2S gas stream.
Construction: Sulfur recovery capacity at Baytown being increased by 100 tons per day; completion, first quarter, 1958.

CONSOLIDATED CHEMICAL INDUSTRIES, INC., Houston.
(Refinery sludge acid and sulfur to sulfuric acid). (See also under "Stauffer").

DAVISON CHEMICAL CO., GARFIELD CHEMICAL, and RICO ARGENTINE, Casper, Wyo.
Construction: Building a 200-ton per day sulfuric acid plant which will use spent alkylation acid and hydrogen sulfide from refineries.

FREEPORT SULPHUR CO., Westville, N. J.
Capacity: 30 tons per day.

GENERAL PETROLEUM CORP., Torrance, Calif.
(H_2S in commercial amine solution).

GULF OIL CORP., Port Arthur, Tex.
Capacity: 120 tons per day.

GULF OIL CORP, Philadelphia.
Capacity: 130 tons per day.

HANCOCK CHEMICAL CO., Watson, Calif.
Capacity: 200 tons per day.

HANCOCK OIL CO., Signal Hill. Calif.
Capacity: 10 tons per day.
Construction: Will complete expansion to 150 tons per day by October 1957.

PETROLEUM CHEMICALS, INC., Lake Charles, La.
Capacity: 20 tons per day.

PURE OIL CO., Lemont, Ill.
Capacity: 20 tons per day.

SHAMROCK OIL & GAS CORP., Sunray, Tex.
Capacity: 30 long tons per day.

SHELL CHEMICAL CORP., Deer Park, Tex.

SINCLAIR REFINING CO., Houston.
Capacity: 30 tons per day.

SINCLAIR REFINING CO., Marcus Hook, Pa.

STANDARD OIL CO. (IND.), Whiting, Ind.
Capacity: 85 tons per day.

STAUFFER CHEMICAL CO., Dominguez, Calif.
(Sulfuric acid from refinery sludge acid —includes facilities for recovery of sulfur from H_2S).

SUN OIL CO., Marcus Hook, Pa.

TEXAS CO., THE, Westville, N. J.

TEXAS CO., THE, Los Angeles, Calif.

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif.
Capacity: 14,000 tons per year.

UNION OIL CO. OF CALIFORNIA, Santa Maria, Calif. (2 plants).
Capacity: Each is 15,000 tons per year.

UNION OIL CO. OF CALIFORNIA, Oleum Calif.
Capacity: 18,250 tons per year.

WILSHIRE OIL CO. OF CALIFORNIA, Norwalk, Calif.
Capacity: 12 tons per day.
Construction: Expanding capacity.

5. CARBON BLACK—U. S.

Furnace Process

CABOT CARBON CO., Ville Platte and Franklin, La.; Pampa and Big Spring, Tex. Gas throughput 48,000,000 cu. ft. per day; oil throughput 4,000 bbl. per day.

COLUMBIAN CARBON CO., Conroe, Tex.; Seagraves, Tex.; Eola, La.; Hickok, Kans.; North Bend, La.

CONTINENTAL BLACKS, INC., Ponca City, Okla. (30,000 lb. per year); Lake Charles, La.

CONTINENTAL CARBON CO., Eunice, N. M. (25,000,000-lb. per year S.R.F. pant); Sunray, Tex. (17,000,000 cu. ft. per day throughput).

CONTINENTAL OIL BLACK CO., Westlake, La.

HUBER CORP., J. M., Baytown, Tex. (110 tons per day); Borger, Tex. (90 tons per day).

PHILLIPS CHEMICAL CO., Borger, Tex. (290,000,000 per year).

SHELL CHEMICAL CORP., Shell Point, Calif.

THERMATOMIC CARBON CO., Division of Commercial Solvents Corp., Sterlington, La.

UNITED CARBON CO., Aransas Pass, Tex.; Shamrock, Tex.; Ryus, Kans.; Ivanhoe, La.

Channel Process

BARNHART HYDROCARBON CORP., Big Lake, Tex.

CABOT CARBON CO., Skellytown and Kermit, Tex. (Gas throughput 50,000,000 cu. ft. per day).

CARBON BLACKS, INC., Rayville, La. (720,000 lb. per year).

COLTEX CORP., Lefors, Tex. (32,000,000 cu. ft. per day gas throughput)

COLUMBIAN CARBON CO., Corpus Christi, Tex.; Lefors, Tex.; Sweeny, Tex.; Eunice, N. M.; Coltexo, Tex.; and Seagraves, Tex.

CONTINENTAL CARBON CO., Eunice, N. M.; Sunray, Tex.

HUBER CORP., J. M., Borger, Tex. (74 tons per day).

RICHARDSON CARBON CO., SID, Odessa, Tex. (75,000,000 lb. per year).

UNITED CARBON CO., INC., Aransas Pass, Tex. (20,000,000 cu. ft. per day throughput; Rayville, La. (1,600, lb. per day); Falfurrias, Tex. (24,000 lb. per day); Eunice, Tex. (90,000 lb. per day); Borger, Tex.; Shamrock, Tex.; Ryus, Kans.

Roller Process

PEERLESS CARBON BLACK CO., Sweeny, Tex. (5,000,000 cu. ft. per day throughput); Gray County, Tex. (12,000,000 cu. ft. per day throughput).

6. CANADIAN PLANTS

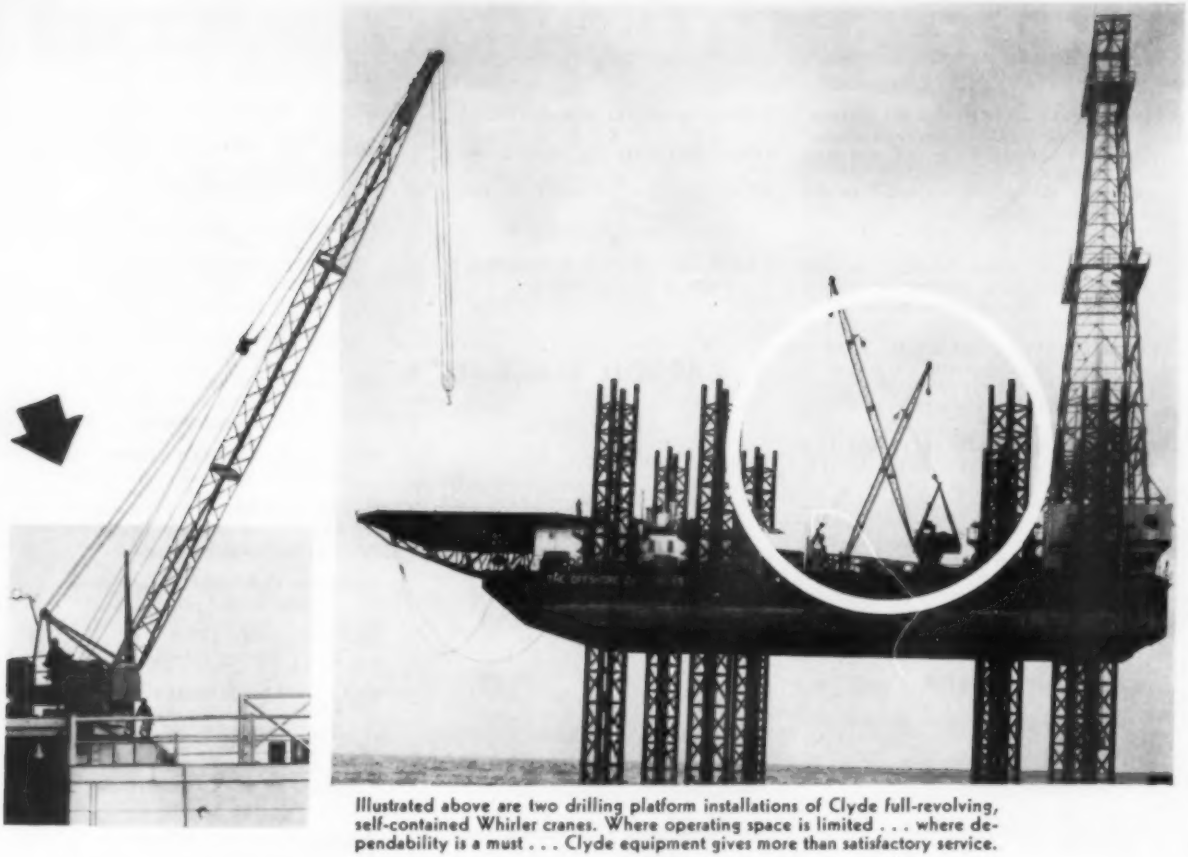
B-A. SHAWINIGAN, LTD., (British American Oil Co., and Shawinigan Chemical), Montreal, Que.
Raw material: Cumene.
Principal products: Phenol (11,000,000 lb. per year); acetone (8,000,000 lb. per year); (byproducts—acetophenone, mesityl oxide, and methyl styrene, 1,000,000 lb. per year); isopropanol.

BRITISH AMERICAN OIL CO., LTD., Montreal, Que.
Raw material: Propylene and benzene.
Principal product: Cumene.

BRITISH AMERICAN OIL CO., LTD., Pincher Creek, Alta.
Construction: Is completing in 1957, a 225-ton per day sulfur plant at a cost of $7,000,000. Plant will later be expanded to 800 tons per day.

CABOT CARBON CO. OF CANADA, LTD., Sarnia, Ont.
Raw material: Petroleum fractions.
Principal product: Oil-type furnace black (over 55,000,000 lb. per year).

CANADIAN CHEMICAL CO., LTD., (Subsidiary of Celanese Chemical Corp.), Edmonton, Alta.
Raw material: Butane; propane.
Principal products: Pentaerythritol (8,500 tons per year); methanol; propylene glycol; dipropylene glycol; n-propanol; n-propyl acetate; acetic acid; acetone; other alcohols, glycols, aldehydes, oxides, detones, and cellulose acetates.



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SURVEY OF PETROCHEMICAL PLANTS

Cellulose acetate capacity 12,500 tons per year.

CANADIAN HYDROCARBONS, LTD., Winnipeg, Man.
Construction: Considering a $25,000,000 plant to produce 80 tons per day of ammonia and 600 tons per day of high-analysis nitrogen fertilizers.

CANADIAN INDUSTRIES, LTD., Edmonton, Alta.
Raw material: Natural gas, from which ethane is obtained.
Principal product: Polyethylene (22,000,000 lb. per year).
Construction: Will complete expansion to 40,000,000 lb. per year by summer 1959.

CANADIAN INDUSTRIES, LTD., Millhaven, Ont.
Raw material: Ethylene glycol and dimethylester of terephthalic acid.
Principal products: Synthetic polyester fiber and flake.
Construction: Building a 200-ton per day ammonia plant.

CANADIAN OIL REFINERIES, LTD., Sarnia, Ont.
Raw material: Refinery streams
Principal products: Hydrogen; methane; ethane; ethylene; propane-propylene; butane-butylenes.

CANADIAN OIL REFINERIES, LTD., Corunna, Ont.
Construction: Will complete last quarter 1957, aromatics facilities (benzene, toluene, and xylenes). A 4,400-bbl.-daily Platformer and a 3,650-bbl.-daily Udex unit being built will cost $3,000,000.

CARBIDE CHEMICALS CO. (Division of Union Carbide Canada, Ltd.), Montreal East, Que.
Raw material: Refinery gases.
Principal products: Ethylene (captive); ethylene oxide; ethylene glycols; polyethylene glycols; glycol ethers; ethanolamines; polyethylene.
Construction: Will increase polyethylene to 50,000,000 lb. per year and ethylene glycol to 30,000,000 lb. per year at a cost of $5,000,000.

CONSOLIDATED MINING & SMELTING CO OF CANADA, LTD., Turner Siding, Calgary, Alta.
Raw material: Natural gas.
Principal products: Ammonia (325 tons per day); ammonium nitrate (200 tons per day).

DOW CHEMICAL CO. OF CANADA, LTD., Sarnia, Ont.
Raw material: Hydrocarbon rich stream; benzene; butadiene.
Principal products: Carbon tetrachloride; diethanolamine; diethylene glycol; dichloroethyl ether; ethanolamine; ethylene glycol; ethylene oxide; hydrochloric acid; perchloroethylene; polystyrene; styrene; styrene butadiene latexes; trichloroethylene; triethanolamine; triethylene glycol.
Raw material: Byproduct hydrogen.
Principal product: Ammonia.
Construction: Has under way projects totaling $7,000,000 and including ethylene glycol, chlorine, ethylene, styrene, and ammonia expansions.

DU PONT CO. OF CANADA, LTD, Maitland, Ont.
Raw material: Cyclohexane; ammonia; carbon tetrachloride; chloroform; polyacrylonitrile.
Principal products: Adipic acid; hexamethylene diamine (nylon intermediates); chlorofluoromethanes; acrylic fiber.
(Du Pont also makes nylon resin at Kingston, Ont.).

ETHYL CORP. OF CANADA, LTD., Sarnia, Ont.
Raw material: Ethyl chloride; ethylene dichloride; ethylene dibromide.
Principal product: Tetraethyl lead.

IMPERIAL OIL, LTD., Sarnia, Ont.
Raw material: Petroleum gas and liquid fractions.
Principal products: Tripropylene (nonene); tetrapropylene (dodecene); detergent alkylate (dodecyl benzene); other phenylalkanes.
Construction: Will complete mid-1958 facilities to produce ethylene, propylene, butadiene, butylenes, aromatic distillates, aromatic tars and petroleum polymers, at a cost of $25,000,000.

JEFFERSON LAKE SULPHUR CO., Taylor Flats, B. C.
Construction: Will complete a 412-ton per day sulfur-recovery plant fall 1957, at a cost of $1,800,000.

JEFFERSON LAKE SULPHUR CO., 19 miles north of Okotoks field near Calgary, Alta.
Construction: Will build a 300-ton sulfur-recovery plant on a Mobil Oil of Canada, Ltd., farmout.

LAURENTIDE CHEMICAL & SULPHUR CO., Montreal East, Que.
Construction: Building a 33,000-long-ton per year sulfur-recovery plant.

LUBRIZOL OF CANADA, LTD., Niagara Falls, Ont.
Raw material: Petroleum fractions.
Principal products: Lube-oil additives.

McCOLL-FRONTENAC OIL CO., Montreal East, Que.
Raw material: Refinery gases.
Principal product: Ethylene.

MONSANTO CANADA, LTD., Montreal, Que.
Raw material: Styrene.
Principal product: Polystyrene.

NORTHWEST NITRO-CHEMICALS, LTD., Medicine Hat, Alta.
Raw material: Natural gas.
Principal products: Ammonia; high-analysis nitrogen and phosphate fertilizers.

PETRO-CHEMSOL CHEMICALS, LTD., Petrolia, Ont.
Raw material: Cat reformate.
Principal products: Benzene; toluene; xylene; aromatic solvents; naphthalene.

POLYMER CORP., LTD. (Crown owned), Sarnia, Ont.
Raw material: Refinery streams.
Principal products: Styrene monomer; butadiene and butyl rubbers; ethylene; isobutylene (120,000 long tons per year of all rubber types).
Construction: Plans increased butadiene-styrene rubber production capacity, construction of new specialty latex plant, and increased butadiene production capacity.

POLYMER CORP., LTD., (Crown owned) Red Deer, Alta.
Construction: Plans a $5,000,000 to $6,000,000, 7,000-ton per year butadiene plant.

QUEBEC AMMONIA CO., LTD., Varennes, Que.
Construction: Plans a 125-ton per day ammonia plant, but plans have been postponed indefinitely.

ROYALITE OIL CO., Turner Valley, Alta.
Raw material: H_2S from natural gas.
Principal product: Sulfur (25 to 40 tons per day).

ST. MAURICE CHEMICALS, LTD., (Shawinigan Chemicals, Ltd., and Heyden Newport Chemical Corp.), Varennes, Que.
Raw material: Methanol; acetaldehyde.
Principal products: Formaldehyde; pentaerythritol.

SHELL OIL CO. OF CANADA, LTD., Jumping Pound, Alta.
Raw material: Sour natural gas.
Principal product: Sulfur (90 long tons per day).

SHELL OIL CO. OF CANADA, LTD., Montreal, Que.
Raw material: Propylene; butylenes
Principal products: Isopropyl alcohol; acetone; secondary butyl alcohol; methyl ethyl ketone.
Construction: Will complete a $1,000,000 epoxy resin unit by end of 1957, and facilities for production of detergent alkylate by early 1958.

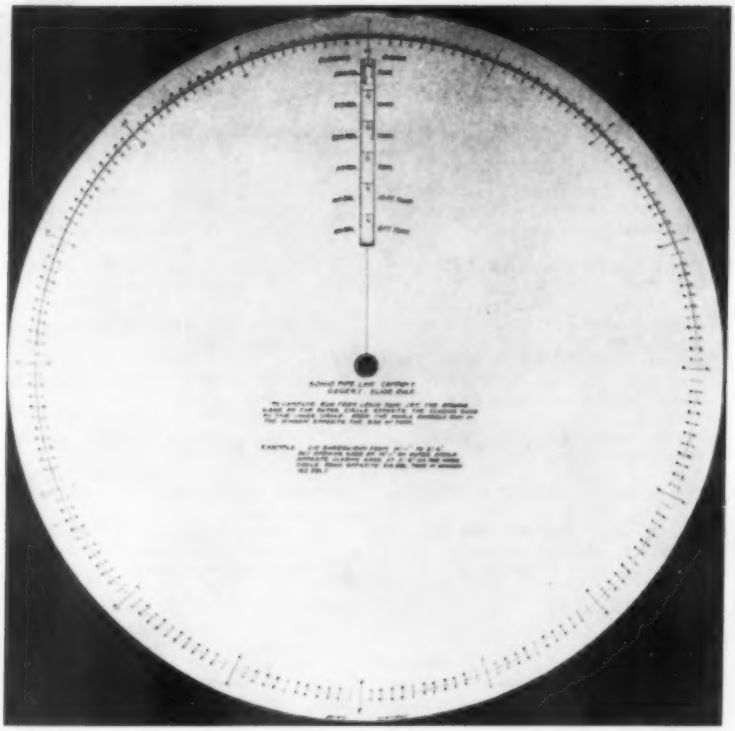
SHERRITT GORDON MINES, Fort Saskatchewan, Alta.
Raw material: Natural gas.
Principal products: Ammonia (90 tons per day); ammonium sulfate (70,000 tons per year).

SUN OIL CO., LTD., Sarnia, Ont.
Raw material: Crude.
Principal products: Gasoline; furnace oil; residual fuel oil; butylenes.

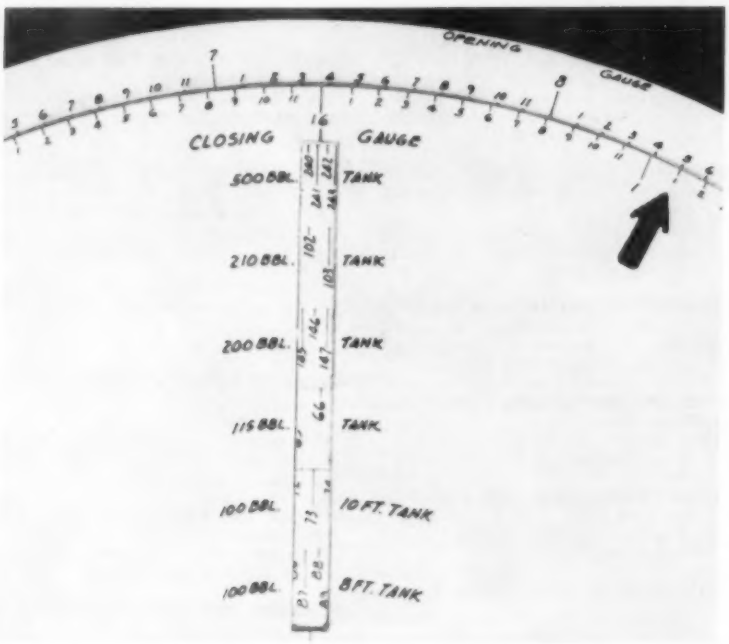
SURPASS PETROCHEMICALS, LTD., Scarborough, Ont.
Raw material: Petroleum fraction polyalkylated benzene; petroleum oxidates.
Principal products: Petroleum sulphonates and derivatives; corrosion inhibitors; oil additives; rust preventives; esters.

VISKING, LTD., Fort Gary. Winnipeg, Man.
Construction: Will build a $500,000 polyethylene plant.

VOSCO INDUSTRIAL CHEMICAL PRODUCTS, LTD., Montreal, Que.
Raw material: Petroleum fractions.
Principal products: Dodecyl benzene and higher alcohols converted to synthetic detergents.



This tool is simply a nomograph which crowds much



information into a little space. It performs as a

Gager's Slide Rule

It has reduced gathering losses to almost zero

By R. L. Johnson
Sohio Pipe Line Co., St. Louis

THE TRISTATE division of Sohio Pipe Line Co. has developed a simple device to compute crude-oil lease-tank runs that has not only proven to be a boon to its field gagers but also seems destined to help improve the stock-control picture for the division.

Called the "gager's slide rule," the device automatically "calculates" the volume of crude oil gathered from a given lease tank upon one setting of its single dial. Economical to construct, simple in its operation, the slide rule has found wide acceptance by veteran field gagers.

Stock-Control Problem

The slide rule has emerged as one result of a continuing effort to improve the division's stock-control record. Sohio's tristate (Illinois, Indiana, Kentucky) gathering operations, nonexistent in the middle thirties, had mushroomed rapidly, the volumes gathered exceeding 15 million barrels a year. Stock control during this period of growth was a matter of secondary importance—the emphasis was on oil movement. As the boom subsided, however, division personnel became increasingly aware of the economic significance and complexity of that problem. But the controls kept slipping away.

Control Barriers

The study of the existing procedure revealed three major barriers to effective stock control:

1. An educational barrier existed. Accounting personnel were unfamiliar with gaging procedures as well as with the vast spider web of Ohio's gathering system; the gagers, on the other hand, were unfamiliar with pipeline accounting methods.

2. A time barrier existed. The immediate prevention of existing errors was impossible since the time consumed in their disclosure prevented on-the-spot corrections from being made. When and if an error was discovered, the damage had already been done.

3. A communication barrier existed. Accounting personnel, confronted with the disclosure of an apparent error, were often unable to determine its significance. The field gagers, while able to interpret the abnormal results disclosed by the accounting process, did not have that information.

As a first step, the stock-control section transferred the preliminary accounting functions to the field. Stock-control clerks were placed in each of the tristate division's four area offices (at Grayville, Norris City, Centralia, and Clay City, Ill.) and were delegated the responsibility of maintain-

ing stock control on an area level. A new system of daily controls was inaugurated under which the field gagers reported to the area clerks all movements handled during the preceding 24 hours. Most reports were made to the area offices by telephone; in some cases radio telephones were used.

Under that system the field gagers reported all tank gagings, b.s. and w., temperature, gravity measurements, and any additional factors (e.g., leaks, truck crude in transit, etc.) that would affect the results calculated from the reported data.

The area stock-control personnel daily summarized each gager's operations with respect to receipts, deliveries, opening and closing inventories, stock on hand, and averages and shortages. Many abnormal losses were discovered and traced to their sources.

These changes in organization, responsibilities, and methods of control reduced stock losses. However, while such was an improvement over the previous method of operations, it was still apparent that the system should function more effectively. The major reason for this lack of effectiveness, it was believed, was the fact that the time and communications barriers, although weakened, still existed. Thus, even though the control accounting functions had been removed to the field, the control of crude movements was, at best, on an area basis.

Field Gager the Key

Attention was again focused on the field gager—the individual who, it was believed, could make or break the entire program. Improvements in stock control had already resulted from the decentralization of the preliminary accounting function. Would further improvement result from further decentralization? If the field gagers could have the tools to enable them to roughly compute the volumes of their lease tank runs, it was argued, many errors could be corrected on the spot. The communications, time, and knowledge barriers would virtually be wiped out, the interdependence between the field gager and the area office minimized. It was decided to make the attempt.

Decentralization Cuts Losses

That decision led to a second redelegation of responsibilities; it demanded that the primary responsibility for stock control be shifted from the area stock-control clerks to the field gagers. It means a further decentralization to approximately 50 small districts, divided among the 4 areas.

The revised procedure improved communications and coordination between the field gagers and area clerks by requiring a system of checks and double checks. Initially the responsibility for computing the receipts, deliveries, opening and closing inventories and overages and shortages for his district was placed upon each field gager. The computations were made using representative tank tables and the results communicated to the area clerk by radio or telephone on a 24-hour basis.

Each area clerk was then responsible for the control accounting, on a net barrel basis, of the crude in all control districts within his control area. He checked the results of the computations of each field gaged within his area and coordinated his activities with those of the other area clerks. If a serious shortage was disclosed, the field gager was again contacted and his computations rechecked. If no arithmetical errors were found, the field gager shut down his district and began searching for the cause of the shortage.

Role of Slide Rule

The results of that system have been highly gratifying; gathering losses in the tristate division are now negligible. The only major problem that remains is one of keeping all personnel "stock-control conscious" and constantly aware of the importance of accuracy in their computations. The gager's slide rule was developed with the latter factor in mind. The premise was that a simplified process of computing lease-tank runs would be less susceptible to error than a more inconvenient and time-consuming method.

The requirement that stock control be accomplished in the field had posed some practical problems. The division's 4,000-odd lease connections are to tanks that vary greatly in size and capacity. The average tank capacity, on the other hand, is only about 150 bbl. The use of representative tank tables had been cumbersome even in the area offices; the field gagers had no office in which to work.

Thus, the possibilities for error which were inherent in the original method of operation were compounded by using tank tables in the field. The need arose for a convenient method of computing lease-tank runs that would eliminate, if possible, arithmetical errors as well as those errors caused by the use of the wrong tank table.

A survey of the lease tanks used in the division revealed that the majority fell into one of seven size and capacity categories. By combining this information with that from the representative tank tables, the gager's slide rule was created.

How It Works

Technically, the term "slide rule" is a misnomer as applied to the principle of operation of the device, since it is simply a nomograph which has been adapted to crowd the largest amount of information into the smallest possible space. The independent variables are the opening gage, printed on the circumference of the outer disk, and the closing gage, printed on the circumference of the inner, movable disk (Fig. 1).

The dependent variables have been printed on the face of the outer disk to appear in the window opposite each tank size after a setting has been made. By matching the opening-gage figure on the outer disk with the closing-gage figure on the inner disk, the volume of the run, in barrels, appears in the window opposite the size of the tank which was gaged.

For example, assume that the opening gage on a 100-bbl., 10-ft. tank was 8 ft. 5 in. and that the closing gage was 1 ft. 1 in. Fig. 2 illustrates the correct setting of the inner dial, the volume of the run, 73 bbl., appears opposite the 100-bbl., 10-ft. tank size on the face of the dial.

What about accuracy? This depends, of course, on the size of the instrument, and is affected, in turn, by considerations of its convenience of portability and use. Sohio has found that by using a slide rule approximately 10 in. in diameter, tank gages can be read to the nearest ⅛ in. and volumes can easily be read to the nearest ½ bbl.

The comparative degree of accuracy of the slide rule as opposed to the representative tank tables is plus or minus 1 per cent. Furthermore, the slide rules which were tested were "home made," having been reproduced photographically and mounted on stiff cardboard. Commercial manufacture of the device would undoubtedly lead to an increase in accuracy, perhaps even with a reduction in size. Since the objective of the new program is to promptly disclose major losses as contrasted with hundredths-of-a-barrel losses, the accuracy of the slide rule is more than adequate.

The slide rule is being used only on a limited, experimental basis. But the possibilities for the application of the principle to the stock-control program for any specific gathering system are apparent, as are its main advantages of convenience, speed, and the inherent elimination of arithmetical error.

Lighter loads, lower costs, equal strength . . . Aluminum is the answer

By F. F. Dietsch and D. V. Wilcox

A MAJOR problem with portable oil-well servicing and drilling derricks is weight. Several recent rigs show that aluminum can be successfully used to reduce weight while maintaining strength.

Three rigs with aluminum masts, one 96 ft. high and two 65 ft. high, show weight savings in masts of 28 to 31 per cent. One of the two 65-ft. rigs uses aluminum in bed frame, decking, and winch frame. Over-all rig weight is reduced 15 per cent by this means.

The 96-ft. rig has been in service for over 2 years. In that time the only major damage that has occurred has been due to collision with other objects. No fatigue cracks have developed. Its ability to take rugged handling and maintain good structural stability is due to aluminum's high damping capacity.

The actual cost of building these three rigs was, of course, higher than for steel. However, development thus far and Reynolds Metal Co.'s experience with aluminum in similar structures indicate that aluminum rigs can be sold competitively with those of steel.

Both this 96-ft. mast and this 65-footer are aluminum . . .

Development

Convinced that the best method of reducing weight in portable derricks is through the use of aluminum, Reynolds engineers approached the industry with this possibility a few years ago. As a result, Franks Division, Cabot Shops, Inc., Tulsa, built an aluminum mast for incorporation in a Franks Giant Clipper, a deep-well servicing unit popular in the Mid-Continent oil-producing area.

On November 3, 1954, the completed unit was first shown to the public and sold to a prominent Oklahoma well-servicing contractor. The over-all height of the unit is 100 ft. and the distance from ground to water table is 96 ft. The folded length is less than 60 ft. The working hook-load capacity is 200,000 lb. with a gross capacity of 600,000 lb.

An assembled mast for a unit of this type weighs about 12,700 lb. in steel as against 9,130 lb. in aluminum. Thus, a 28 per cent savings in weight was realized. The design of this first mast was understandably conservative, and a savings of up to 50 per cent can be expected in future aluminum masts.

This unit has been in operation for over 2 years now under severe loading and rugged handling conditions, but there have been no joint failures. Loadings in excess of the 200,000-lb. capacity have caused no damage. The decreased weight has made moves easier. In addition, its structural stability, when erected, is superior to that of a similar steel mast.

Other parts aluminum . . . Last year Franks built two Rocket 44TD derricks for Phillips Petroleum Co. One of these has an aluminum mast only. The other has an aluminum mast and as much of the remainder of the derrick is aluminum as was feasible in the time allotted. Both of these derricks have been delivered and are in operation.

These two derricks have an over-

Authors are, respectively, project director and assistant chief welding engineer, Reynolds Metals Co.

all height of 68 ft. and the dimension under the water table is 65 ft. The folded length is 48 ft. 8 in. The workload capacity is 100,000 lb.

The weights for the parts converted to aluminum as compared to steel are as follows:

	Alum. lb.	Steel lb.	Per cent savings
Mast (without cable)	5,360	7,754	31
Bed frame, decking and supports	1,783	3,558	50
Winch frame only	564	1,205	53
Total weight delivered	37,000	43,000	15

This savings of 15 per cent, which is 6,600 lb., places the aluminum rig well within the legal road limits for the 44TD derrick. The equivalent steel derrick is 3,600 lb. over the limit which necessitates an additional truck to carry certain gear such as the block.

Structure . . . Current steel rigs are primarily welded, round-tubular structures. The joints of such a design are composed of several members welded together in a relatively small area. This extremely high concentration of welds is not desirable in aluminum structures since aluminum alloys lose some of their strength when welded. The loss can be reduced, however, by controlling the amount of heat used in welding.

One of the biggest factors in the control of heat is weld concentration. Spreading of the weld over as large an area as possible reduces the intensity of heat introduced. A square-tubular structure employing two extruded aluminum gusset sections or saddles, as shown in Fig. 1, will do this. Fig. 2 shows these two sections welded in place in a horizontal frame. Note that the section having two gusset plates is used on the back of the frame which is closed by a crossmember, and the single is on the front which is the open side without a crossmember. The frame fits the four legs of the mast. Fig 3 shows a single-gusset section welded to the front leg.

In this latter figure, note the longitudinal weld in the background. This weld is along the neutral axis of the section. Wherever feasible the welds were located in such noncritical areas. It can readily be seen that the heat-affected areas due to weld concentration can be minimized by the use of the saddles. The parent metal thickness is also increased in these highly stressed areas.

Tolerances . . . Fit of the members to be welded is important in the control of heat. If the gap between members is excessive, additional filler metal must be laid down. This increases the amount of "as cast" structure in the weldment, which, in itself, is harmful and necessitates the use of additional heat.

In a square-tubular design all mating surfaces are straight line rather than curved, as is the case with the round-tubular design. Good joint fit, therefore, is much simpler to obtain in the aluminum design.

Welding Methods

Aluminum can be welded by several different methods. To obtain optimum mechanical strength, however, a process of high torch temperatures is required. This is due to aluminum's high thermal conductivity. The higher the heat and the more rapidly it can be applied, the better the metal will flow and complete the weld.

Under these conditions the heat introduced into the parent metal will be minimized, as will the formation of cost structure in the weld zone. In this latter respect, penetration in excess of 1/16 inch is not required to obtain a satisfactory weld provided the surface is properly wetted.

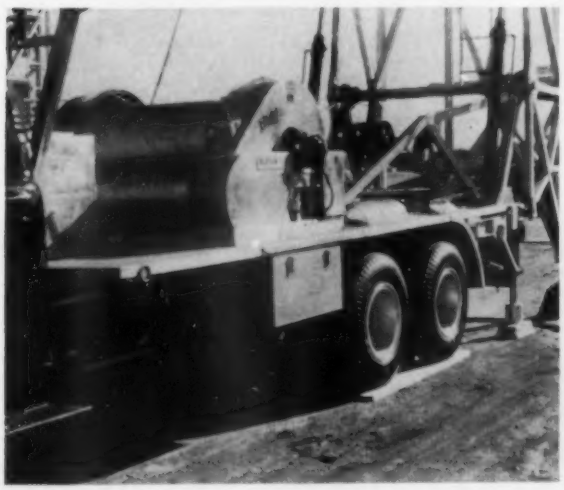
High temperature . . . The inert-gas, shield metal-arc process affords arc temperatures of 9,000° F. or higher, which is the highest available on commercial equipment. This concentrated arc force permits directing the energy to a narrow weld zone and melting the weld surfaces sufficiently to permit a satisfactory bond without excessive penetration and heat.

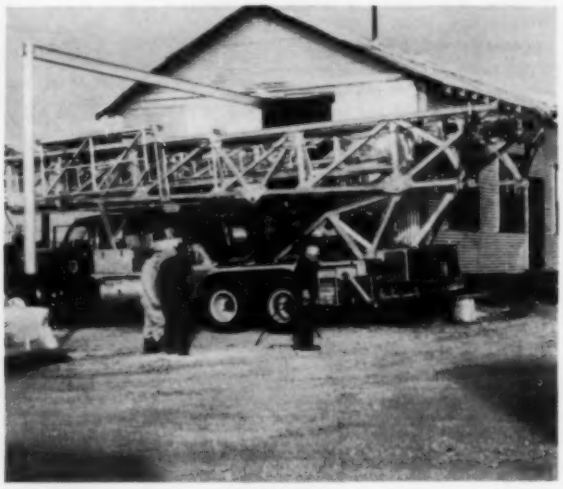
There are two types of inert-gas welding processes. One is the tungsten arc and the other the consumable metal arc. The former uses tungsten electrode to strike the arc and the filler metal is introduced by hand. In the second process, the filler metal is the electrode and is continually fed to the weld area as it is consumed. Because of the better control afforded by the consumable metal-arc process, this method was used for welding the derricks.

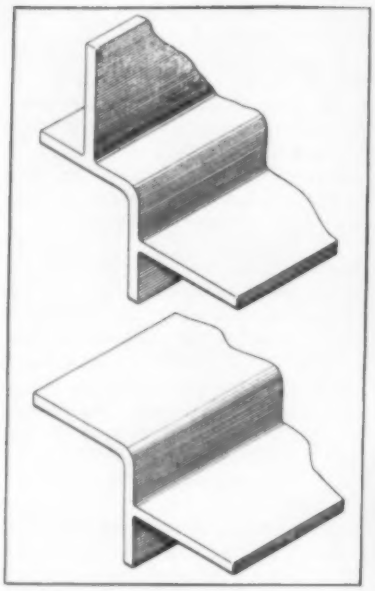
Pattern . . . Weld pattern or sequence is also very important in the control of heat. A weld pattern was established for the horizontal frames and the mast assembly in such fashion that a bare hand would not be burned when placed near the completed weld moments after welding.

One side of a horizontal frame was welded in the flat position starting at the center crosspieces and working

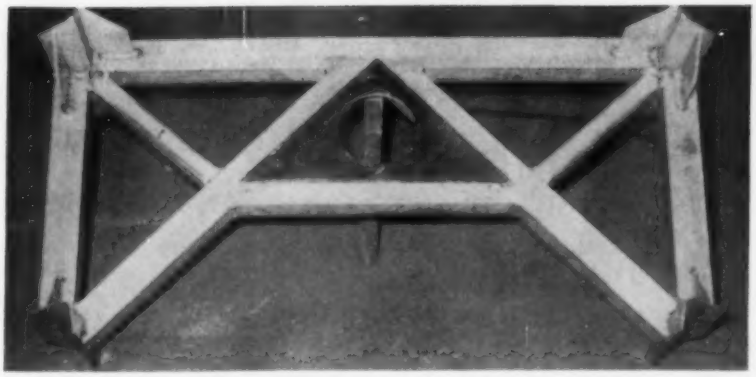
. . . with aluminum beds, frames, decking . . . . . to cut road weight 15 per cent



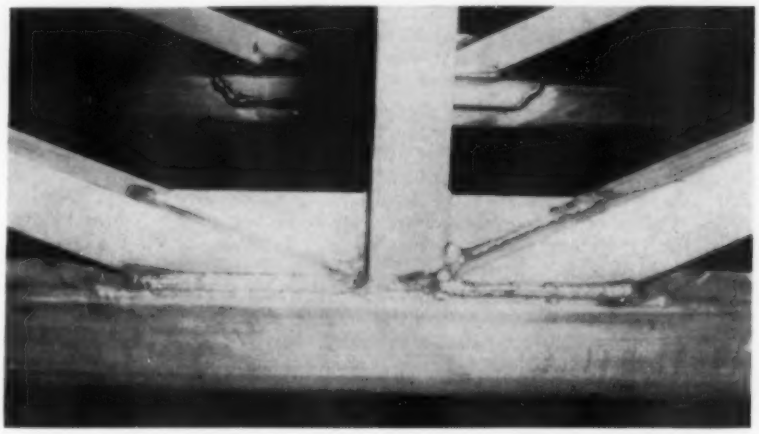




TWO EXTRUDED aluminum shapes carrying integral gusset plates for welding. Fig. 1.



HERE'S HOW the extruded aluminum sections with integral gusset plates (in Fig. 1) were used in the welding assembly of a horizontal frame. Fig. 2.



FRONT WELD CLUSTER shows how the extruded aluminum section with single gusset is employed. Notice that cluster of members in back have the long horizontal weld placed in the neutral axis. Fig. 3.

outward in a zig-zag fashion. It was then rotated 180° and the other side welded in the same order. The frame was then rotated 90° and the inside welds completed in the same order. The opposite inside welds were then made after rotaing 180°.

Materials . . . The 6061-T6 aluminum alloy was used for the structural members of the three derricks. This alloy was selected because of its good weldability, good strength characteristics, and high resistance to corrosion. It is available in many forms—plate, sheet, bar, rod, and extruded shapes. Specified minimum yield strength for 6061-T6 is 35,000 psi. with a typical strength of 40,000 psi.

Filler metal used for the first derrick was 4043 aluminum alloy, which has been the principal alloy recommended for this purpose by the aluminum industry for many years.

Tensile tests were made of welded joints of 3 by 3 by 3/16 in., 4 by 4 by 5/16 in., and 4½ by 4½ by ⅜ in. square tubes having a splice cut of 30° and reinforcing sleeves on the inside or outside. On the basis of these tests a working stress of 27,500 psi. was selected with a factor of safety of 1½ to 2 depending upon the nature of the particular section.

A stress survey of the completed 96-ft. derrick under varying conditions of loading employing strain gages substantiated this assumption. For the last two derricks, the welding rod was changed to 5154. Although the use of this wire offers an increase of 5½ per cent in tensile strength, the same working stress and factors of safety were used as for the first derrick.

Easier to clean . . . With the inert-gas welding process, no cleaning is necessary to remove flux after welding. This would probably not be of much concern if the finished structure required painting. The aluminum derrick, unlike a steel derrick, does not require painting to protect it against corrosion.

Nelson Refinery Construction Index

Appears in the Engineering Section in the first issue each month.
Compiled by W. L. Nelson, Petroleum Refinery Consultant, Tulsa.
The Index was explained October 1, 1956 (page 110), as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issue of the months of January, April, July, and October.

Index (1946 = 100)

	1949	1952	1954	1955	1956	May 1957
Pumps, compressors, etc.	135.9	155.6	166.5	172.2	192.0	203.7
Electrical machinery	130.9	152.4	160.0	162.5	175.0	187.3
Internal-combustion engines	124.8	146.5	150.5	153.2	164.0	173.5
Instruments	123.1	146.2	154.6	162.9	182.1	186.2
Heat exchangers	133.0	165.8	171.7	156.8	190.7	209.0
Miscellaneous equipment average	*121.6	153.3	160.7	161.5	180.5	192.1
Materials component	143.6	164.3	174.6	176.1	190.4	199.8
Labor component	137.1	163.1	183.3	189.6	198.2	206.1
Nelson construction index	139.7	163.6	179.8	184.2	195.3	203.6

*Used in computing the Nelson Index until April 1952. This is slightly different than the average of the Miscellaneous Equipment Items shown above.

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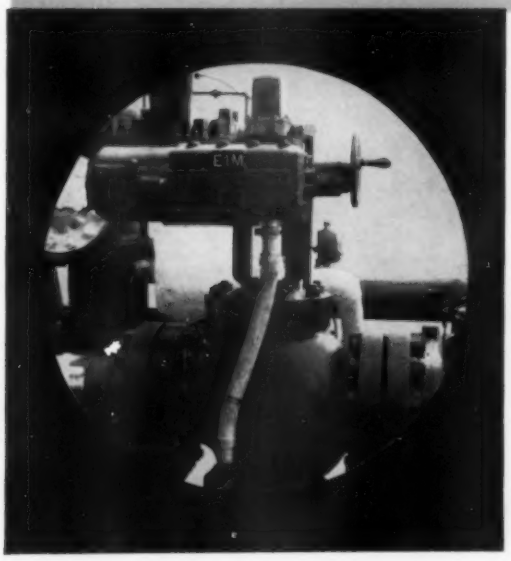

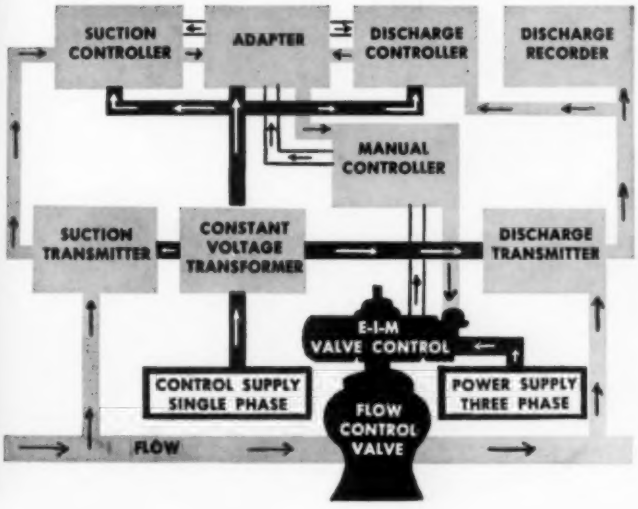

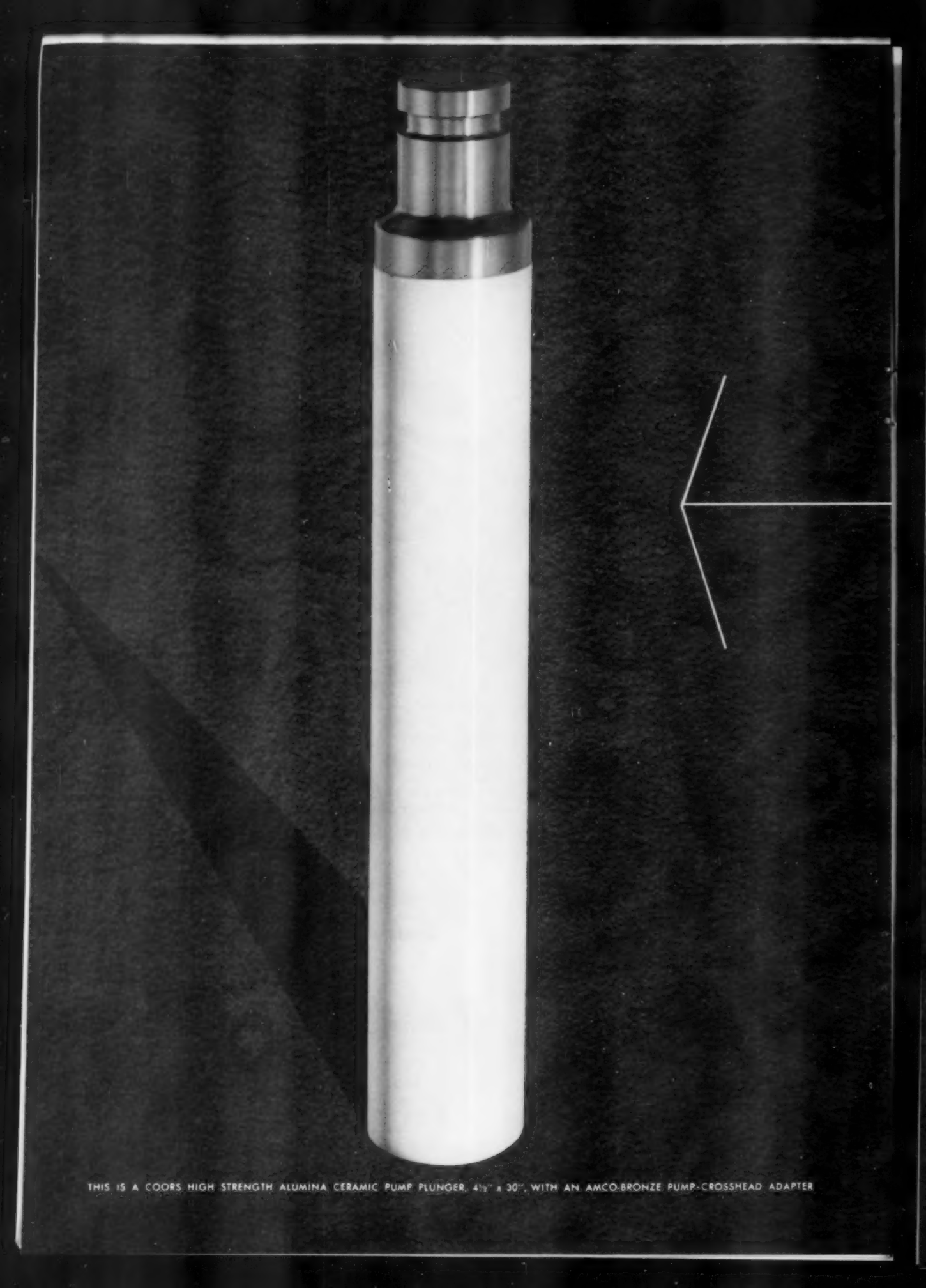

THIS IS A COORS HIGH STRENGTH ALUMINA CERAMIC PUMP PLUNGER, 4½" x 30", WITH AN AMCO-BRONZE PUMP-CROSSHEAD ADAPTER

Coors CERAMIC

...how it solves problems of abrasion and corrosion

IN RECIPROCATING PUMP PLUNGERS

Plungers for reciprocating pumps are an example of how design engineers are using Coors High Strength Alumina Ceramic to combat abrasion and corrosion. The applications vary from small chemical proportioners to oil field water flood pumps, operating under many different abrasive and corrosive conditions. For these requirements, Coors makes solid ceramic plungers in a latitude of diameters from ⅛″ to 6″ and in lengths up to 48″.

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PROPERTY	UNIT	COORS Vitrified High Strength Ceramic TYPE AB-2
Tensile Strength	psi	17,000 - 18,000
Compressive Strength	psi	over 200,000
Flexural Strength	psi	42,000 - 45,000
Specific Gravity		3.40
Hardness	Moh's Scale	9
Maximum Working Temperature	°F	2550
Closest Machined Tolerances	inches	0.000020

DESIGN ENGINEERS — Coors High Strength Ceramic materials and Coors production facilities offer many product design possibilities to engineers where dimensional accuracy, corrosion, abrasion, and heat problems are a factor. For design details and complete mechanical properties, please refer to our 12-page catalog in Sweet's Product Design File.

PUMP USERS — Coors High Strength Alumina Ceramic pump plungers may be obtained only from your pump manufacturer—some pump manufacturers stock our solid ceramic plungers.

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Pushbutton stations designed to withstand even the most Corrosive Conditions

Here is one of the most practical developments to come along in recent years—Allis-Chalmers heavy duty push-button stations. From the phenolic BM-2498 enclosure to the Type 316 stainless-steel hardware, this line of pushbutton stations is exceptionally resistant to corrosive action of chemicals.

For the first time a proven-in-service, roll-action operator is completely protected by a rugged, corrosion-resistant enclosure. This assures longer, trouble-free operation in chemical plants, refineries, paper mills, or any industrial application where corrosive atmospheres normally cause pushbutton failures.

The complete line of Allis-Chalmers corrosion-resistant pushbutton stations includes:

- single or two-button units
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- lockout attachment
- pilot lights

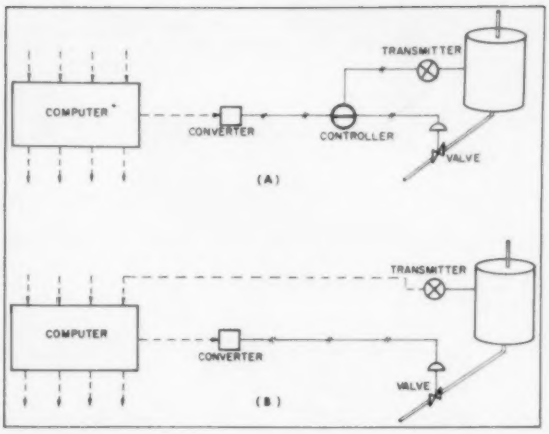
This newly designed pilot light has the same phenolic enclosure as the pushbutton stations, and is available as either single or double units. Wide angle lenses of flexible vinyl plastic have greater range of visibility, and are available in any combination of red, green, amber, blue, or white. Bayonet-type bulbs are used to resist shock. Primary voltages are to 550 volts; secondary voltage is 6.3.

For further details call your nearest A-C District Office or Distributor . . . or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5526

NEW DIGITAL control computer is small by usual computer standards. It measures 55 in. in over-all length, is 29 in. wide, and is 36 in. high. It weighs about 400 lb.



PROCESS CONNECTIONS for the control computer can be made in two ways: (a) supervising conventional controllers, and (b) as substitute for conventional controllers. Fig. 1.

Push-button refinery comes a step nearer as

New Digital Computer Is Especially Designed for Process Control

By D. H. Stormont
District Editor

A GREAT STEP toward the much-discussed "push-button" refinery will take place next year. A new digital control computer, specifically designed for automatic control of refinery and petrochemical processes, is scheduled to be incorporated into the control setup of a refinery process.

When used as a central unit of a process control system, the new computer can automatically read process instruments, perform the computations necessary to relate these readings to process objectives, determine the control actions which will result in optimum plant operations, and activate the process mechanisms or adjust set points on supervised controls loops to bring about the desired operations.

Incorporated within the new computer, which has been developed by Ramo-Woolridge Corp., are control equipment which allows it to be connected directly to process instruments and control devices (Figs. 1 and 2). These include integral input-output buffering, selection, and analog-digital conversion equipment. The computer accepts inputs from practically any kind of process instrument.

According to the developer, the new computer can carry out a number of functions in automatic on-line process control: For example:

... In input-data interpretation, it does scaling, linearizing, and compensation for interferences.

... In computing, it can do maximizing, minimizing, averaging, correlating, smoothing, equation solving, interpolation, extrapolation, and integration.

... In plant operations, it can start up and shut down process units, make comparisons with standard conditions, and select material flow paths.

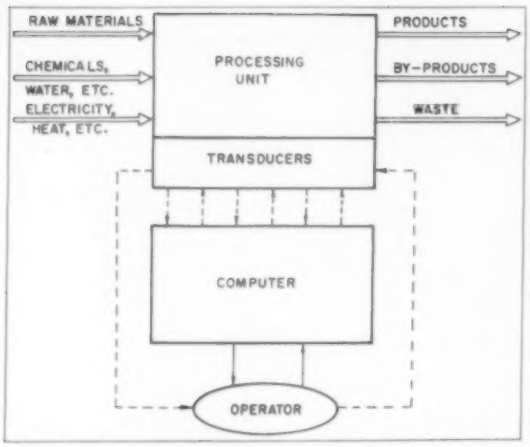
... In checking and alarm operations, it can make instrument checks, process stability checks, and computer self-checks.

... As a data logger, it converts measurements of process instruments into digital numbers which are printed out to provide permanent records of process variables. These data are available to the operator, the process engineer, and the accounting department.

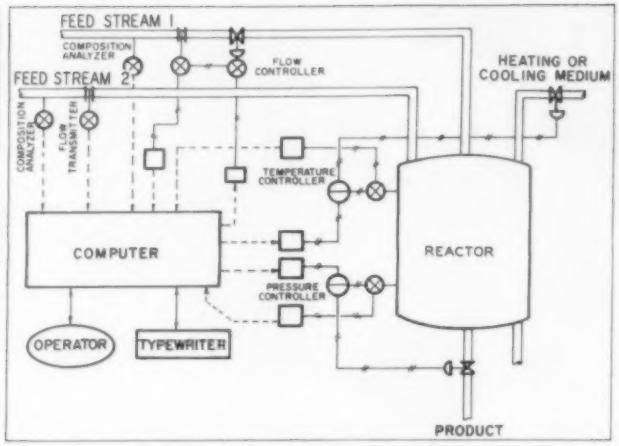
Initially it is expected that the new computer, designated RW-300, will be used largely to supervise conventional controllers. Used in this manner, the control computer can be disconnected from the process at any time. The controller set points can then be allowed to remain at their previous positions or adjusted manually until the computer is back in operation.

Computer features ... The new computer is classed as a general-purpose, magnetic - drum - storage, stored-program serial machine. Fully transistorized, it is only 55 in. long, 29 in. high, and 36 in. wide.

It uses binary numbers internally, although decimal inputs and outputs can be supplied through use of a convesion routine. It has a word length of 17 bits plus sign. Using a "one-plus-one address" instruction type, it has 19 instructions. It has 7,936 words of general storage (62 tracks of 128 words each), 16 words of fast-access storage in a 16-word circulating register, and one track for a loading program. Average access time to the gen-



COMPUTER CONTROL SYSTEM may be set up to eliminate conventional controllers. Transducers condition measurement impulses for computer interpretation. Fig. 2.



TYPICAL OIL-INDUSTRY PROCESSES will be able to integrate the control computer into the instrumentation setup easily and efficiently, as shown here. Fig. 3.

eral storage is 8.3 milliseconds.

Depending on the equipment used, and frequency that analog inputs or outputs are desired, it is possible to have a total of 128 analog inputs and outputs with only one buffer track. If the particular process being controlled requires more inputs and/or outputs, then more buffer tracks will be needed.

Digital input facilities consist of a Flexowriter punched-paper tape reader, and 12 on-off inputs. Digital output facilities are provided by a Flexowriter which prints at 10 characters per second or may punch a paper tape at the same rate. In addition there are 12 on-off outputs. This complement of input-output equipment can be expanded; a total of 1,000 are possible.

Modular design is used wherever possible in the computer. All active circuits are mounted on inserts, which are in turn attached to the modules that plug into the subframe. This approach makes the addition of input-output facilities considerably easier, and allows each module to be serviced independently to cut computer down time.

What it costs . . . Ramo-Woolridge engineers estimate that the cost of the first computer control systems will be in the range of $100,000 to $150,000. This would include the basic computer, some analog-digital and digital-analog converters, but not the cost of special input-output equipment.

Cost of the computer system, however, probably will be only a portion of the total cost of adapting an existing process to automatic control. There probably will have to be changes made to the plant. These may consist of only a few new instruments or controllers, with attendant equipment and installation costs. Or it may be that extensive changes in piping, vessels, and storage facilities are required.

Process Optimization

A typical refining or petrochemical process is shown in Fig. 3. Two feed streams are combined and sent to a reactor in which temperature, pressure, and perhaps liquid level are controlled.

A flow controller on one feed stream, a flow transmitter on the other, and composition analyzers on both streams send information to the computer for feed-ratio calculations. These calculations may involve a simple linear proportioning, or, if one feed stream is more costly than the other, increased yield may be balanced against cost to determine the relative amounts that should be used. Such a calculation could take into consideration feed rates, feed composition, feed costs, reaction conditions, and rate of product withdrawal. These factors and changes in them can be continuously evaluated by the computer.

Other conditions may need to be evaluated if optimum operating conditions are to exist. The effects of residence time, pressure changes, temperature level, may also be determined. This includes a balancing of reactor conditions and with optimum product yield. The computer will keep the process operating continuously at optimum conditions as long as prescribed points for each individual variable lie within the range of permissible operating conditions.

Fixed-bed catalytic processes used in some refining and petrochemical operations have continuous feed, combined with periodic regeneration or replacement of the catalyst. There is an optimum time in each process for this catalyst renewal. The control computer can keep a continuous record of catalyst activity and, by balancing this activity level with catalyst costs and past catalyst effectiveness history, can determine the time for regeneration or renewal.

Startup and shutdown operations can also be handled by the computer. This is done by programing the sequence of manual operations for these periods.

Alarm functions . . . The control computer can also be programed to spot trouble in a process and in the control system. As a part of its data-logging function the computer can check to see that the variables are within their permissible ranges. Also it can be set up to determine dangerous trends. It can check for the occurrence of related events which might indicate trouble.

For example, an apparent sudden increase in reaction temperature, not accompanied by corresponding changes in related process conditions, may mean faulty signal transmission or a faulty temperature-indicating device. The computer can be set up to so indicate.

Checks can be built into the computer and programed to be sure that the required calculations are being made properly and that the various components of the computer are functioning correctly.

When any malfunctioning is found, the computer can be set up to print out an alarm signal. If major equipment failure occurs, the computer may be programed to shut down the process.

How Rock and Fluid Properties Affect Flow in the Reservoir

What does affect two-phase permeabilities? Findings of this study indicate factors that should be considered. Use of these results could lead to better oil recovery.

By F. E. Merliss, J. D. Doane, and M. J. Rzasa

Conclusions from the study . . .

1. There is no simple relationship between the bulk physical properties of a porous medium and the permeabilities to immiscible fluids flowing simultaneously inside the medium.
2. Over the range of viscosities and viscosity ratios studied, permeability ratios are insensitive to the viscosity of the driving phase and are affected only slightly by changes in the viscosity of the driven phase.
3. Rate effects are possibly a factor in the determination of permeabilities but the evidence presented here is inconclusive.
4. Pressure in itself or through its effect on some of the physical properties of the fluids affects the permeabilities to the fluids in two-phase flow.
5. In two-phase flow, density of the fluids is not the factor through which pressure affects the permeability to either fluid.
6. The interfacial energies, fluid-fluid and fluid-solid, are influencing factors in the determinations of two-phase permeabilities and therefore warrant further investigation to isolate and formulate the effects of the energies involved.
7. Permeabilities in two-phase flow are not single-valued functions of fluid saturations for a particular porous medium but are dependent upon the fluid distributions among and within pores of the medium.
8. The production mechanism, through its effect on saturation history and consequently the fluid distributions, must be added to the numerous factors that affect the permeabilities in a two-phase system.

Results of this investigation indicate that the effect of interfacial energies on two-phase permeabilities warrants further study. This effect should be recognized and included in any correlation of permeabilities in a two-phase system along with fluid saturations, saturation histories, and rock geometry.

HIGHEST RETURN from production of oil from a reservoir depends upon ultimate oil and gas recovery, recovery rate, laws and regulations, recovery processes, and the timing of such processes. In turn, the factors just cited depend on the fluid-flow characteristics of that particular reservoir.

Permeability, a measure of the flow characteristics, directly affects reservoir performance. Commonly accepted factors affecting the permeabilities are fluid saturations and saturation history. Other factors may also be present.

Introduction

To predict reservoir fluid-flow characteristics more accurately, all pertinent variables must be recognized and their effects known. It is presently known that flow characteristics are affected by rock properties, both physical and chemical, and the saturation and distribution of the fluids contained in the rock.

Use of field data . . . Effects of these flow variables are not easily found from observed reservoir performance. They cannot be easily discerned from the effects of such factors as nonuniformity of the producing horizons, lack of knowledge of the reservoir extent, and uncertainty of the production mechanism. Therefore, some other source of data must be used to find the basic effect of flow variables.

Most of these limitations to using field data for deriving accurate flow formulas can be minimized in the laboratory. Even there, three-phase flow, as it exists in most reservoirs, is still too complicated for study using available meager knowledge of two-phase flow as background. Therefore, study of two-phase fluid flow seems a logical beginning for a fuller understanding of flow processes and their application to reservoirs.

Authors are with Cities Service Research & Development Co., Merliss and Doane at Tulsa, and Rzasa at Cranbury, N. J.

This article presents results from the initial stage of such a study. Included are results of external gas and water drives, solution-gas drives, and steady-state flow. Results do not support the theory that permeability to each flowing phase in a two-phase system is a function of saturation only.

Background and Theory

All of the commonly used methods for the determination of two-phase fluid-flow characteristics have a common basis. They depend on the flow in porous media conforming to Darcy's law and its ramifications. This means that the equation:

$$Q_n = \frac{K_n A}{\mu_n} (dP/dL)_n \qquad (1)$$

applies to each phase individually.

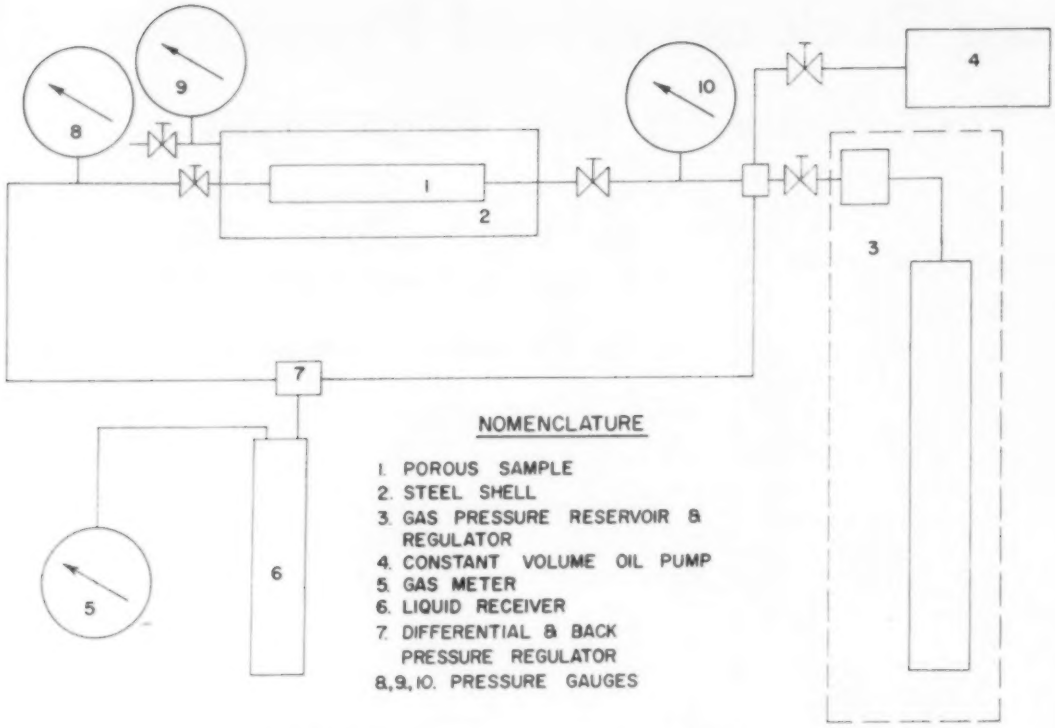
Equation 1 and its corollary:

$$\frac{K_n}{K_m} = \frac{Q_n \mu_n}{Q_m \mu_m} \qquad (2)$$

as they stand, involve no assumptions and do not require any experimental verification unless the variables which determine the K values are defined. It follows then that any experimental study of two-phase flow in porous media is not a test of Equation 1 but is in effect merely an investigation of K.

Variables affecting K . . . There seems to be a widespread acceptance among the users of Equations 1 and 2 of a theory that in the absence of capillary effects the number of variables which determine K is two, namely the pore geometry of the medium and the saturations of the contained fluids. It is, however, unfortunate that as yet no general functional relationship between the values of K and the variables that are presumed to determine them has been formulated.

The existing experimental methods



EQUIPMENT setup for two-phase flow studies. Fig. 1.

for the determination of fluid-flow characteristics are primarily designed for use in evaluating K as a function of fluid saturation for a particular porous medium. Most of the methods which are used and described in the literature[1 2 3 4 5 6] can be classified under three general headings. These are (1) the external-drive technique, where the wetting phase is driven from the medium by the injection of a nonwetting phase; (2) solution-gas-drive technique, in which the driving force is supplied by the gas which is in solution in the liquid; and (3) the steady-state technique, in which both phases are injected and produced simultaneously.

Measuring methods . . . The difference in these methods necessitate a variation in the technique used for the determination of point fluid saturation. Any technique involved is based on either mathematical relationships such as the material-balance equation and the frontal-advance differential equation and its solution by Welge,[8] or on X-ray absorption and gravimetric measurements.

The mathematical relationships which are most directly related to the various experimental and calculation techniques used in this investigation stem from material-balance equations.

In 1941, Buckley and Leverett[7] derived the material-balance differential equation and, by skillful mathematical manipulation, re-presented it as the now well-known frontal-advance equation:

$$d_L = \frac{Q_t}{A\phi}\left(\frac{\delta f_D}{\delta S_D}\right)_\theta d\theta \qquad (3)$$

The usefulness of the frontal advance equation was greatly enhanced when Welge,[8] using the reasoning of Buckley and Leverett that f_D is a function of θ and L only to the extent that they affect S_D, succeeded in obtaining a solution for it. Buckley and Leverett's reasoning, stated in mathematical language is that:

$$\left(\frac{\delta f_D}{\delta S_D}\right)_\theta = \frac{df_D}{dS_D} \qquad (4)$$

i.e., that what Equation 3 presents as a partial derivative is physically a total derivative.

Welge went farther than merely integrating Equation 3. He used the integrated form of the equation:

$$L_{SD} = \frac{V_i}{A\phi}\frac{df_D}{dS_D} \qquad (5)$$

the definition of an average saturation:

$$S_D = \frac{\int S_D\, dL}{\int dL} \qquad (6)$$

and some very clever mathematical manipulations to arrive at an equation:

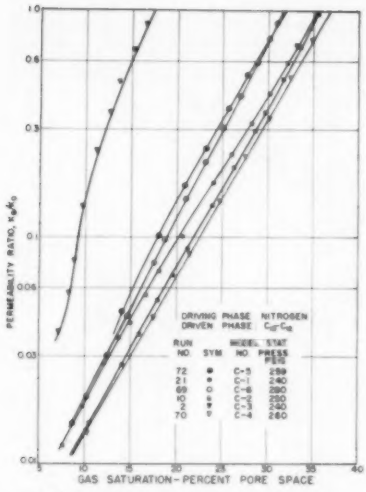
$$S_L = (S_D)_d + \frac{(1 - f_D)_d V_i}{A\phi L} \qquad (7)$$

from which the saturation profile in an external-drive experiment could be calculated from measurable quantities.

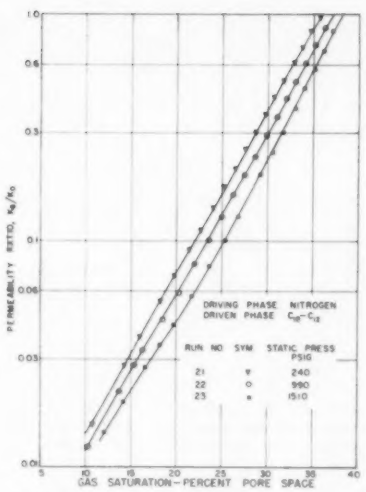
In addition to the material-balance differential equation there is a simple material-balance used for solution-gas-drive experiments. The equation relating the variables is:

$$S_o = [(V_o - V_p)/V_o]\ \beta/\beta_o \qquad (8)$$

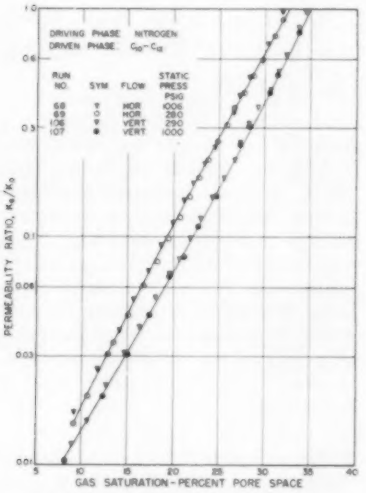
At this point it seems appropriate to state that saturation gradients are assumed to be negligible or nonexistent in solution-gas drives; therefore the producing characteristics for this type experiment can be correlated with the average saturation as calculated from Equation 8. The same assumption is made for steady-state flow but for this type of experiment the average saturation is determined by gravimetric means. It is necessary, however, to realize that the assumption that saturation gradients are negligible ceases to be valid when the pressure



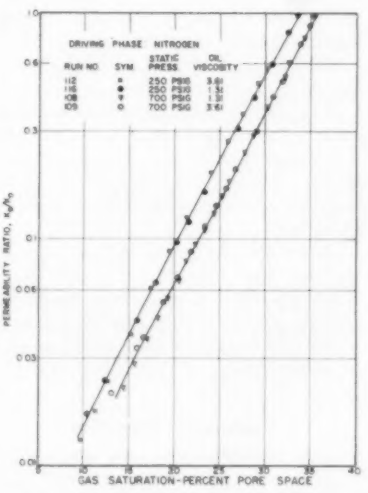
COMPARISON of two-phase flow characteristics for six models. Fig. 2.



EFFECT of static pressure on the two-phase flow characteristics of Model C-1. Fig. 3.



EFFECT of gravity segregation on two-phase flow characteristics of Model C-6. Fig. 4.


PERMEABILITY RATIO, K_g/K_o
GAS SATURATION – PERCENT PORE SPACE
DRIVING PHASE NITROGEN
RUN NO. SYM STATIC PRESS OIL VISCOSITY
112 250 PSIG 3.61
116 250 PSIG 1.31
108 700 PSIG 1.31
109 700 PSIG 3.61

EFFECT of driven phase viscosity on two-phase flow characteristics of Model C-6. Fig. 5.

drop across the model is great enough to cause an appreciable gas expansion.

Flow Experiments

The equipment setup used in this study is shown in Fig. 1.

1. A porous material sample encased in a Lucite tube.
2. A pressure-tight steel shell in which the sample is mounted when high-pressure work is performed.
3. A gas pressure reservoir with pressure regulator (used only in external drives and steady-state studies).
4. Constant-volume oil pump (used in steady-state studies only).
5. A gas meter used to measure the gas volume produced.
6. Graduated glass burette to measure the liquid volume produced.
7. Differential-pressure and back-pressure regulator.
8, 9, and 10. Pressure gages to measure pressures at points indicated in Fig. 1.
11. Miscellaneous valves as indicated in Fig. 1.

Preparation of model . . . An encased model is placed in the high-pressure steel shell and pressure is applied to the outside of the Lucite casing to balance the pressure inside the model. This is merely a safety measure which makes it possible to perform flow studies at higher pressures than the Lucite can withstand internally. The model is evacuated and weighed together with the shell on a high-capacity, high-sensitivity balance.

Oil is then flowed through the model at a high pressure with a high-pressure differential until the model is saturated. The model and shell are weighed again to determine the amount of fluid in the pore space. The model is now ready for flow tests. This procedure is common to all of the flow studies performed by any of the three experimental methods used.

External drive . . . For external-drive experiments an upstream gas pressure is set and controlled from a gas bottle using a reducing pressure regulator. For gas drives, the gas is admitted directly to the system. The pressure drop across the model is controlled by use of the differential - pressure regulator. The outlet of the model is connected to the receiving system which is the graduated glass burette and the wet test meter.

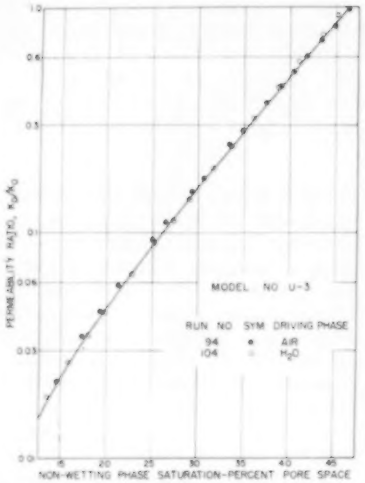
The water-drive experimental setup differs from the gas-drive setup in that the gas pressure is applied to a high-pressure water reservoir to drive the water into the model at the controlled pressure, and the wet test meter is disconnected from the system. In all experiments where water was one of the flowing phases, unconsolidated sand columns were used. This precaution was taken in order to eliminate the effects of an interaction between the water and the binding material of consolidated porous media that results in alterations of the rock geometry.

In both gas and water drives the pressure gradients maintained are sufficiently high to minimize the effect of capillary pressure gradients.

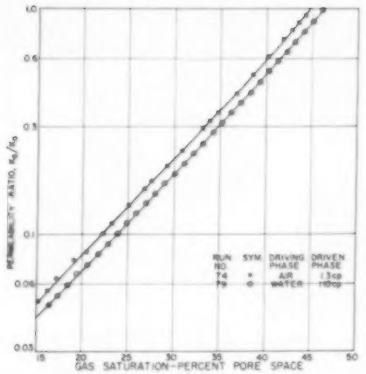
Cumulative volumes of produced fluids are measured simultaneously during gas and water drives. A plot of cumulative produced gas (or water) versus cumulative produced oil is made. The slope of the resulting curve at any point of oil production is equal to the instantaneous gas-oil (or water-oil) ratio at that point. From the instantaneous producing ratio the producing characteristics of the model are calculated, using the Welge technique.

Solution-gas drive . . . When performing solution-gas drives, care must be taken that the system on the upstream side of the model be gas free. This precaution is necessary to eliminate the danger of any gas entering the model as the pressure is depleted in the system which would cause a partial external gas drive. Filling the upstream system with an incompressible liquid in which the gas is not soluble insures the desired condition. Mercury or a high-molecular-weight, high-viscosity oil is satisfactory for this purpose. From this point on, the operating procedure is the same as that for the external-drive experiments.

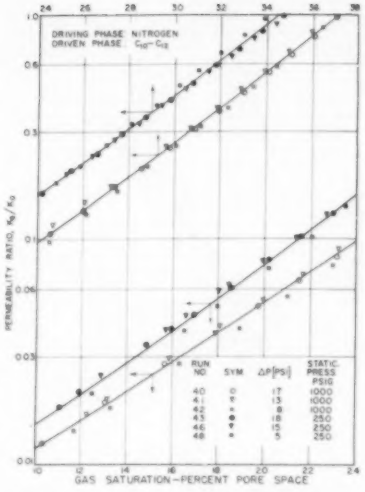
Steady-state flow . . . The procedure



EFFECT of driving phase viscosity on two-phase flow characteristics of Model U-3. Fig. 6.



EFFECT of simultaneous variation of fluid viscosities and interfacial tension on two-phase flow characteristics of Model U-1. Fig. 7.


DRIVING PHASE NITROGEN
DRIVEN PHASE C10-C12
RUN NO SYM ΔP PSI STATIC PRESS PSIG
40 ○ 17 1000
41 ▽ 13 1000
42 ▪ 8 1000
43 ● 18 250
44 ▼ 15 250
45 ▪ 5 250
GAS SATURATION-PERCENT PORE SPACE

EFFECT of pressure differential on the two-phase flow characteristics of Model C-1. Fig. 8.

used to perform steady-state-flow experiments differs from the external-drive procedure in that both oil and gas are injected into the model. With a preset downstream back pressure, while the model is fully oil saturated, a constant oil-injection rate is established which imposes a constant pressure drop across the model. The control pressure of the gas reservoir is then set at value slightly higher than the upstream pressure. Gas is then allowed to merge with the oil stream entering the model.

The injection of the two phases is continued until a steady flow condition is indicated by a constant producing gas-oil ratio and an oil-producing rate which is equal to the oil-injection rate. At this point the individual flow rates are recorded, the model is shut in, the injection equipment is shut off, and the model is disconnected from the system and weighed. From this weight and the weight of the fully saturated model the fluid saturations are calculated.

The producing characteristics of the model, at the calculated saturation, are determined from the recorded gas and oil flow rates. To cover the range of saturations of interest a series of these determinations is made beginning each time with a different oil flow rate and a fully saturated model.

Materials . . . The materials used in this study were selected in order that a wide range of fluid and porous-media properties be represented. The flow models included both consolidated and unconsolidated sands. The consolidated models were made from sandstones from the Torpedo, Big Heart, and Nelly Bly outcrops, and the unconsolidated models were made of Ottawa silica sand. Some of the unconsolidated sand models, normally water wet, were treated with silicone material to make them oil wet in the presence of water.

Table 1 is a resume of the characteristics of the models.

The fluids used in this investigation were straight-chain hydrocarbon cuts (one consisting mainly of the C_{10}-C_{12} fraction), water, methane, carbon dioxide, nitrogen, helium, hydrogen, and air.

Although the gases just mentioned are not found in all reservoirs, they were included to cover the range of gas properties that might be encountered and should be considered in any complete study of fluid flow relationships.

Results and Discussion

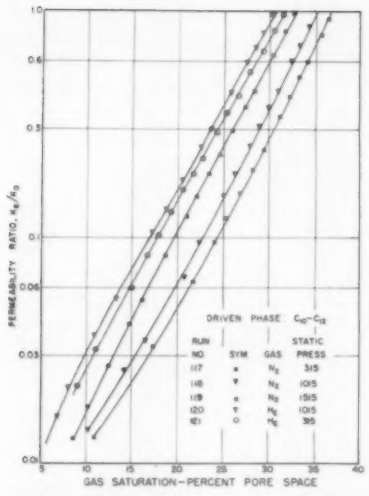
It was mentioned in the theory section that the permeability, K, to each fluid in a two-phase system, is generally believed to be independent of all variables except rock geometry and fluid saturations. Also mentioned was the fact that no general functional relationship between the permeability, rock geometry, and fluid saturation has been formulated.

This study was undertaken with a dual purpose. The first purpose was to determine whether the permeability is truly independent of the variables which had been eliminated or whether it is merely insensitive to these variables in the range of conditions which were imposed in the previous experimentations. The second purpose was to accumulate data which could eventually be utilized in the formulation of a general correlation between permeability and the variables that determine it.

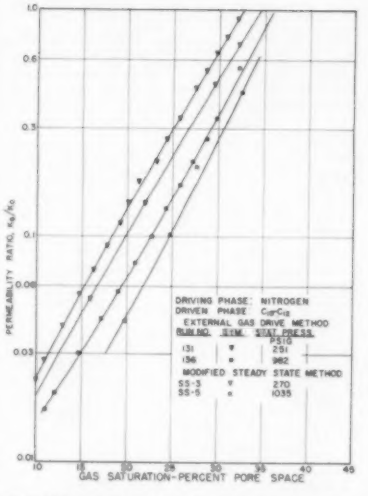
Range of variables . . . To achieve these purposes the effects of variables, which have been eliminated but could conceivably affect the permeabilities if varied sufficiently, were studied together with the effects of the variables known to affect permeabilities. The variables included in the studies

TABLE 1—PROPERTIES OF TEST CORES

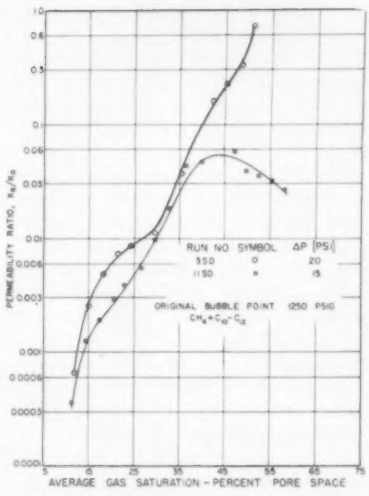
Core No.	Length (cm.)	Diameter (cm.)	Permeability (md.)	Porosity (per cent)	Silicone treated	Sand mesh	Number of experiments performed
Consolidated Models							
C-1	25.4	5.08	100	18.4	No	.....	56
C-2	25.4	5.08	60	18.8	No	.....	5
C-3	25.4	5.08	1.5	13.3	No	.....	4
C-4	16.0	4.05	17.4	20.0	No	.....	2
C-5	15.2	4.05	200	20.9	No	.....	2
C-6	77.5	4.30	286	18.7	No	.....	24
C-6A	59.7	4.30	275	18.7	No	.....	12
Unconsolidated Models							
U-1	60.9	2.50	8,260	34.64	Yes	80-120	8
U-2	62.9	2.54	9,730	33.65	No	80-120	4
U-3	26.7	3.77	7,270	37.49	Yes	80-120	5
U-4	26.7	3.77	14,400	38.48	No	50-70	3
U-5	63.8	3.81	19,600	35.39	No	50-70	3


PERMEABILITY RATIO, K_g/K_o
GAS SATURATION—PERCENT PORE SPACE
DRIVEN PHASE C_{10}–C_{12}
RUN NO. SYM GAS STATIC PRESS
117 • N_2 315
118 ▼ N_2 1015
119 ▪ N_2 1515
120 ▼ H_2 1015
121 ○ H_2 315

TWO-PHASE flow characteristics of Model C-6 for helium-oil and nitrogen-oil systems at various static pressures. Fig. 9.



COMPARISON of the two-phase flow characteristics of Model C-6A obtained from two experimental methods. Fig. 10.



TWO-PHASE flow characteristics of Model C-1 derived from solution-gas-drive experiments. Fig. 11.

and the ranges over which they were varied are presented in Table 2.

TABLE 2—TEST VARIABLES

Variable—	Range of variation
Oil viscosity, cp.	1.3-110
Gas viscosity, cp.	0.009-0.020
Static pressure, atm.	1-100
Pressure drop (consolidated models only), psi.	5-20
Interfacial tension, dynes/cm.	1-35
Gas molecular weight	2-44
Model properties	See Table 1
Production mechanism	See flow experiments
Direction of flow	Horizontal and vertical

The results of all the determinations are presented in Figs. 2 through 11. Figs. 2 through 9 represent the results of the external-drive experiments, Fig. 10 the steady-state experiments, and Fig. 11 the solution-gas-drive experiments.

If it were true that the individual permeabilities, in two-phase system, are unaffected by variables other than fluid saturations and rock geometry the figures, with the exception of Fig. 2, would have resulted in a single curve. This is obviously not the case.

Difference in models . . . Each figure represents the pursuit of the effect of one or more of the variables listed in Table 2. Fig. 2 presents a series of curves in which the permeability ratios are plotted as functions of fluid saturation for six models having different physical characteristics. The results of the determinations on the six models, performed under comparable experimental conditions, are noted to be six separate curves. This is not unexpected because it is already recognized that pore geometry is one of the major factors that determine the permeabilities in two-phase flow. It must be noted, however, that there are no obvious directional trends of the permeability ratios with any of the properties of the models listed on Table 1.

Effect of pressure . . . The resulting effect of the pressure variable is shown in Fig. 3. To arrive at these results, all variables known to be affected by pressure were corrected for this effect wherever the quantitative relationships between the variables and pressure were known. Those corrected include the gas viscosity, gas compressibility, the solubility of the gas in the oil, and the resulting change in the oil viscosity and specific volume. In spite of these corrections the three curves remain separated.

Separate additional experiments were performed to determine whether or not corrections for rock compressibility are needed. It was found that these effects are negligible to the extent of being unmeasurable in the Lucite-mounted models.

No gravity influence . . . Fig. 4 presents the calculated results of experiments performed where both the pressure and the direction of flow were varied. This approach was used to obviate any effect of gravity segregation. At the conditions imposed it is obvious that the direction of flow has no significant effect; however, the effect of pressure is both in direction and order of magnitude the same as that noted in Fig. 3.

Effect of viscosity . . . To obtain results on the effect of viscosity, experiments were performed using a 1.31-cp. oil and a 3.61-cp. oil. Four determinations were made, one for each oil at each of two pressures (250 and 700 psig.). The results (Fig. 5) indicates that the permeability ratio is either independent of or insensitive to a change in oil viscosity of this magnitude. The same effect of the pressure variable is again noted.

When the driving-phase viscosity was varied approximately 50 fold, using the same oil in both cases, there was essentially no change in the permeability ratios. Shown in Fig. 6 are the results obtained when driving a 110-cp. oil in one case with water and in the other case by air. To insure that the oil was the wetting phase in both cases an unconsolidated-sand model which had been silicone treated was used. It may be significant to note that the interfacial tension between water and this oil is the same as that between air and this oil.

Another silicone-treated unconsolidated-sand model was used to perform two experiments where for one a 110-cp. oil was driven with water and for the other a 1.3-cp. of oil was driven with air. Results of these determinations are presented in Fig. 7.

It is noted that there is approximately a 15 per cent difference between the permeability ratios calculated at any saturation for these two determinations. It should be stated that this result may not be entirely due to the changes in viscosity of the driven phase because there was a simultaneous change of about 10 to 12 dynes per cm. in the interfacial tensions between the two pairs of fluids, which was more than likely accompanied by changes in the fluid-solid surface energies.

Rate of flow . . . Another of the variables listed in Table 2 is the pressure

differential which controls the rate of flow of the two fluid phases. The effects of this variable were studied at two pressure levels, 250 and 1,000 psig. The difference in pressure across the models was varied from 5 to 18 psi.

There is some rate effect noted in the results (Fig. 8) at both pressure levels but this effect is only slightly greater than the experimental uncertainty. The variations due to changes in the pressure level are again exhibited.

Driving phase . . . In order to determine whether or not the pressure is in itself a factor that affects the ratio of the permeabilities or whether it is a factor only through its effect on some fluid property, experiments were performed where both the pressure and the driving fluid were varied. The results, Fig. 9 and Tables 3, 4, 5, 6, and 7, suggest that pressure is a variable only through its effect on some physical property of the driving phase. This is evidenced by the fact that permeability-ratio curves are obtained which are not only different curves for each gas at each pressure but are also different in the direction of shift with pressure.

The gases represented in Fig. 9 are nitrogen and helium. Their properties that vary with pressure are density, viscosity, and the energies associated with the interfaces between the gases and the solid or the liquid. Any one of these properties could conceivably be the one through which pressure affects the permeability ratios. The analysis of Fig. 6 has already eliminated viscosity of the driving phase as an influencing factor and the effect of pressure on density, being in the same direction for both gases, leads to the conclusion that density is not a major factor either.

Interfacial energy important . . . In absence of other unrecognized properties, interfacial energies remain the unconfirmed properties through which the pressure affects the permeability ratios. Confirmation or elimination will come when data on interfacial energies become sufficient.

It is interesting to note that the effect of pressure on the surface energy at a helium-water interface has been reported[9] to be opposite to that at a nitrogen-water interface.

Also of interest are the results of experiments in which a surface-active agent was used to change the interfacial tensions between the fluids, in external water drives, from 35 dynes per cm. to the order of 1-2 dynes per cm. The surface-active agent undoubtedly changed the surface energies between the fluids and the solid.

The results nonetheless indicate interfacial tensions to be influencing factors in the determinations of permeability ratios. This was concluded after it was observed that 60-65 per cent of the oil, with which the model was originally saturated, had been recovered before water breakthrough, which in some cases did not occur. In these cases, the formation of emulsions at the oil-water interface plugged the model and prevented continuation of the experiment.

This 60-65 per cent recovery before breakthrough as compared to 15 per cent, which is the recovery realized before breakthrough when no surface-active agent was used, stresses the importance of interfacial tension.

TABLE 3—DISPLACEMENT OF OIL WITH NITROGEN (FIG. 9)

Run No. 117		Model No. C-6	
Atmospheric pressure, psia.	14.32	Oil viscosity, cp.	1.31
Upstream pressure, psig.	330	Gas viscosity, cp.	0.0180
Downstream pressure, psig.	300	Gas: Nitrogen	

Cumulative produced oil (cc.)	Produced free gas (cc.)	G.O.R. at P_4	K_g/K_o	S_g	S_g
40.2	73	0.9579	0.013	19.3	8.7
42.7	170	1.318	0.018	20.5	10.1
45.1	271	1.991	0.0273	21.7	12.5
47.4	428	2.993	0.041	22.7	14.8
49.1	568	3.836	0.053	23.5	16.2
52.3	950	6.022	0.083	25.1	18.7
55.9	1,523	9.023	0.124	26.8	21.0
57.9	1,907	10.92	0.150	27.8	22.1
60.1	2,515	13.86	0.190	28.9	23.4
62.2	3,186	16.96	0.232	29.9	24.5
65.1	4,256	21.66	0.297	31.2	25.9
68.0	5,644	27.48	0.376	32.7	27.4
71.4	7,887	36.57	0.50	33.6	28.3
74.4	10,425	46.42	0.64	35.7	30.4
77.3	13,804	59.17	0.81	37.1	31.7
79.5	16,828	70.15	0.96	38.2	32.7

TABLE 4—DISPLACEMENT OF OIL WITH NITROGEN (FIG. 9)

Run No. 118		Model No. C-6	
Atmospheric pressure, psia.	14.32	Oil viscosity, cp.	1.31
Upstream pressure, psig.	1,020	Gas viscosity, cp.	0.0180
Downstream pressure, psig.	1,000	Gas: Nitrogen	

Cumulative produced oil (cc.)	Produced free gas (cc.)	G.O.R. at P_4	K_g/K_o	S_g	S_g
48.0	448	1.041	0.0143	23.1	10.3
51.4	871	1.891	0.0259	24.7	14.1
54.8	1,242	2.530	0.0347	26.3	16.5
59.3	2,608	4.905	0.067	28.7	20.7
60.7	3,783	6.948	0.095	29.2	22.3
64.8	6,485	11.16	0.153	31.1	25.0
66.8	8,231	13.74	0.188	32.1	26.2
69.9	11,631	18.55	0.254	33.6	27.9
72.0	14,612	22.63	0.310	34.6	29.0
73.9	17,849	26.94	0.37	35.5	29.9
75.9	21,897	32.18	0.44	36.5	31.0
79.0	30,800	43.50	0.60	37.9	32.5
81.1	37,301	51.31	0.70	38.9	33.4
83.1	38,935	62.10	0.85	39.9	34.4

TABLE 5—DISPLACEMENT OF OIL WITH NITROGEN (FIG. 9)

Run No. 119		Model No. C-6	
Atmospheric pressure, psia.	14.32	Oil viscosity, cp.	1.31
Upstream pressure, psig.	1,530	Gas viscosity, cp.	0.0180
Downstream pressure, psig.	1,500	Gas: Nitrogen	

Cumulative produced oil (cc.)	Produced free gas (cc.)	G.O.R. at P_4	K_g/K_o	S_g	S_g
52.5	617	0.9692	0.0133	25.2	11.0
57.5	1,692	2.429	0.0333	27.6	17.3
61.6	3,503	4.697	0.064	29.5	21.6
64.7	5,468	6.979	0.096	31.0	24.1
66.4	7,152	8.892	0.122	31.9	25.4
68.8	9,537	11.43	0.157	33.0	26.9
70.8	12,478	14.55	0.199	34.0	28.2
73.0	15,887	17.97	0.246	35.0	29.4
76.2	23,183	25.12	0.344	36.6	31.2
78.8	28,888	30.50	0.42	37.5	32.2
80.2	36,213	37.29	0.51	38.5	33.2
82.1	43,168	43.41	0.59	39.4	34.1
85.2	58,428	56.59	0.78	40.9	35.6
87.1	70,729	67.05	0.92	41.8	36.5

Steady-state results . . . The results of the determinations in which the steady-state method was used are presented in Fig. 10. The resulting curves are similar to the curves obtained when the external drive method is used and the same effects with pressure are noted. It is, however, apparent that the curves obtained are similar but not identical. The lack of identity may be attributed to the fact that even when two saturations are equal the distribution of the phases among and within the pores and consequently the permeability to each phase may be different. If this is true, it would follow that permeability is, mathematically speaking, a path function of saturation. This means that the production history and consequently, the production method must be added to the numerous factors that affect the permeabilities in a two-phase system.

Solution-gas drive . . . The above statement is further supported when the results of the solution-gas-drive experiments are studied. Fig. 11 shows the results from two typical determinations. It is difficult to accept the experimental data shown in these latter two figures without admitting, in effect, that not only saturation but also how this saturation was attained must be known before permeabilities can be predicted.

Nomenclature

A = cross-sectional area of the model (cm.^{2})
f_D = fraction of displacing phase in total flow rate
GOR = gas-oil ratio
K = permeability (darcies)
K_g = permeability to gas (darcies)
K_m = permeability to some phase m (darcies)
K_n = permeability to some phase n (darcies)
K_o = permeability to oil (darcies)
K_w = permeability to water (darcies)
L = length (cm.)
P = pressure (atm.)
Q_m = rate of flow of phase m (cc./sec.)
Q_n = rate of flow of phase n (cc./sec.)
Q_t = total flow rate (cc./sec.)
S_D = point saturation to displacing phase (per cent of pore space)
$\mathbf{S}_D$ = average value of S_D (per cent of pore space)
S_g = point saturation to gas (per cent of pore space)
$\mathbf{S}_g$ = average value of S_g (per cent of pore space)
$\mathbf{S}_o$ = average saturation to oil (per cent of pore space)

TABLE 6—DISPLACEMENT OF OIL WITH HELIUM (FIG. 9)

Run No. 120		Model No. C-6	
Atmospheric pressure, psia.	14.29	Oil viscosity, cp.	1.31
Upstream pressure, psig.	1,030	Gas viscosity, cp.	0.0196
Downstream pressure, psig.	1,000	Gas: Helium	

Cumulative produced oil (cc.)	Produced free gas (cc.)	G.O.R. at P_d	K_g/K_o	$\mathbf{S}_g$	S_g
32.4	478	1.095	0.0163	15.6	6.6
34.3	668	1.445	0.0215	16.5	7.9
39.0	1,321	2.515	0.0375	18.7	10.9
43.3	2,108	3.617	0.054	20.8	13.2
50.3	4,779	7.054	0.105	24.2	17.2
53.4	6,468	8.993	0.134	25.6	18.8
56.7	9,138	11.98	0.179	27.2	20.4
61.2	13,779	16.73	0.249	29.4	22.5
63.4	17,201	20.16	0.300	30.4	23.6
68.7	27,142	29.33	0.44	33.0	25.9
72.2	38,496	39.61	0.59	34.7	27.5
74.6	45,888	45.72	0.68	35.8	28.5
75.5	50,839	49.98	0.74	36.3	28.9
78.8	69,209	65.25	0.97	37.8	30.3

TABLE 7—DISPLACEMENT OF OIL WITH HELIUM (FIG. 9)

Run No. 121		Model No. C-6	
Atmospheric pressure, psia.	14.29	Oil viscosity, cp.	1.31
Upstream pressure, psig.	1,030	Gas viscosity, cp.	0.0196
Downstream pressure, psig.	1,000	Gas: Helium	

Cumulative produced oil (cc.)	Produced free gas (cc.)	G.O.R. at P_d	K_g/K_o	$\mathbf{S}_g$	S_g
37.7	205	1.476	0.0220	18.1	9.1
40.1	316	2.136	0.0318	19.3	11.0
46.9	698	4.039	0.060	22.5	15.1
48.7	1,017	5.664	0.084	23.4	16.7
50.7	1,294	6.924	0.103	24.3	17.8
53.2	1,714	8.742	0.130	25.5	19.2
55.6	2,220	10.82	0.161	26.7	20.5
57.2	2,640	12.51	0.186	27.5	21.6
59.9	3,287	14.89	0.222	28.7	22.6
63.3	4,600	19.69	0.293	30.4	24.3
65.6	5,670	23.43	0.35	31.5	25.4
68.4	7,164	28.40	0.42	32.8	26.6
71.3	9,290	35.33	0.53	34.2	27.9
74.2	12,155	44.38	0.66	35.6	29.3
77.1	15,643	55.01	0.82	37.0	30.5
79.2	18,740	64.10	0.96	38.0	31.5

V_t = total volume of fluid injected (cc.)
V_o = volume of atmospheric oil originally in place (cc.)
V_p = volume of atmospheric oil produced (cc.)
β = oil shrinkage factor at a pressure P
β_o = oil shrinkage factor at original bubble point
θ = time (seconds)
μ_m = viscosity of phase m (cp.)
μ_n = viscosity of phase n (cp.)
ϕ = porosity (per cent)

The subscript d denotes that the quantity is measured at the outflow end of the model.

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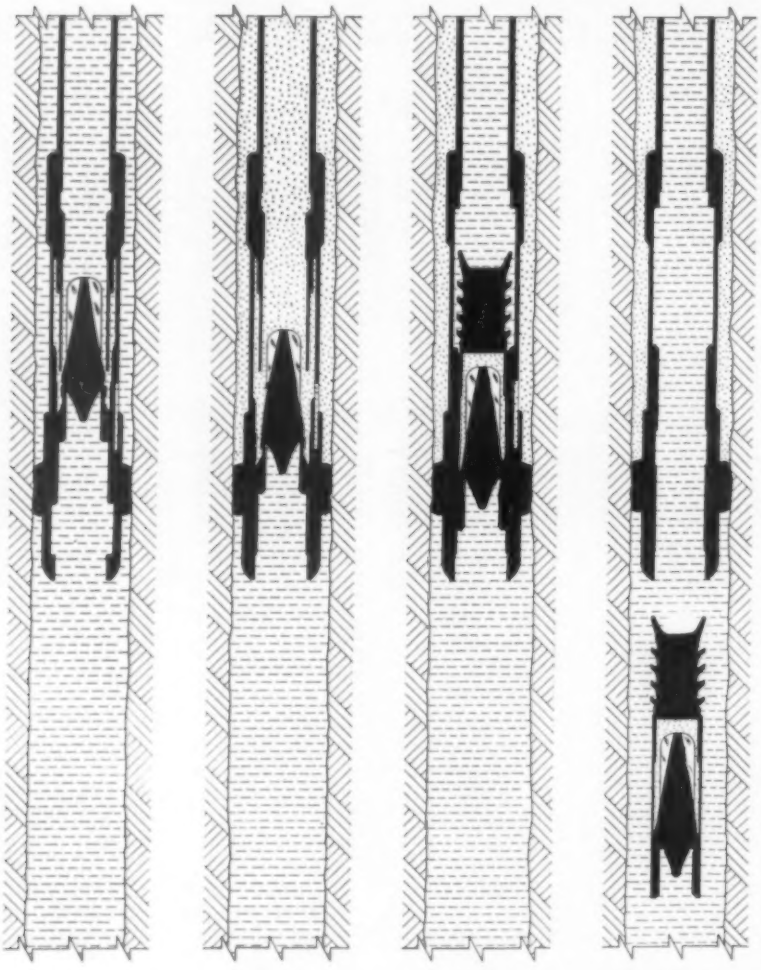


OPERATING DIAGRAM showing the casing shoe in action.

Casing Shoe Eliminates Plug Drillout

Seats and plugs are pumped out after cementing

A RECENTLY developed casing shoe has a formation packer to give protection to formations below the shoe during cementing of tubing or casing. The seats and plugs in this shoe are pumped out after cementing operations, leaving nothing to be drilled out. Some of the applications for the shoe are:

1. Added protection for weak formations during cementing of tubing or casing in oil, gas or water-injection wells.

2. For reworking old wells to be fractured or treated to improve production. Tubing or casing is cemented first, then fracturing is carried out below it.

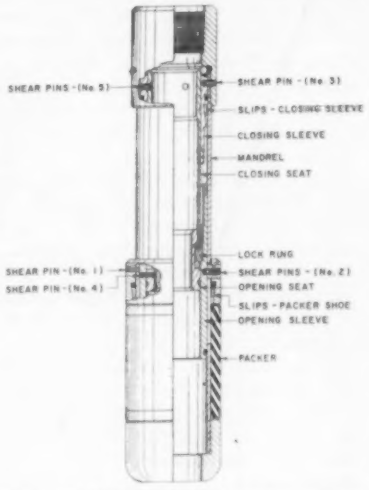
3. Plugging back or killing wells having excessive bottom-hole pressure. The packer is set and cemented while the tubing is left open until cement sets. Then the well is squeezed through the tool.

4. For wells where ordinary or regular packer shoe cannot be used because formation water pressure below the packer is greater than the head of cement outside the casing.

5. For any well where the completion time can be reduced by eliminating drilling out after cementing.

6. For cementing casing above air or gas-drilled zones without contaminating the zones.

This information is from "A Full Opening Casing Packer Shoe," by Norman Oliver, Halliburton Oil Well Cementing Co., Duncan, Okla. The paper was presented at the spring meeting of the Eastern District of the A.P.I. Division of Production, Pittsburgh, Pa.



FULL-OPENING-DESIGN casing packer shoe.

How it works . . . The sequence of drawings shows the use of the new shoe. First, the casing is run to final position with the shoe open. Circulating ports are closed. Then an opening plug or bomb is dropped to block the shoe opening.

With the opening plug seated, pressure is applied to the casing. This shears a pin and sets the packer. Further pressuring then shears the pins holding the opening seat. As the opening seat moves downward the cementing ports are opened.

After the cement is pumped down, a closing plug is dropped and pumped into place. This engages the closing seat. Pressure applied to the casing then shears pins which permit a sleeve, the seat, and plug to move downward. This closes the circulating ports.

When cement sets, further pressure is applied to the casing and another pin shears. This releases seats and plugs which move on out of the bottom of the tool. A full opening is left.

For dry holes, the opening plug is placed on the seat before makeup of the tool. When the tool is run to desired depth, the casing is filled with water or mud to help set the packer and open the tool. The closing plug may be pumped down with kerosine or oil to keep water or drilling fluid off the formation below.

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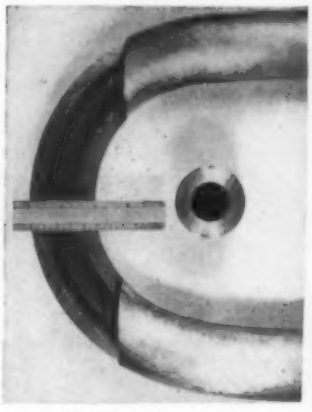
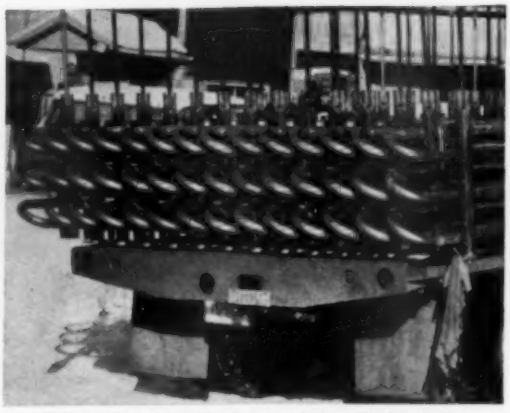


Cutaway and end view of heavy wall duplex.

Welding bent tube ends on to straight tube lengths.



Assembled tube coils showing tube ends in place.

5,016 Feet of Heavy Wall Bridgeport Duplex Tube Provide Economical Answer to Unusual Pressure and Corrosion Problem

Unique Fabrication Methods Used to Bend 22-ft. Lengths to Small Radius

In building a new anhydrous ammonia plant for Northern Chemical Industries of Maine, the designer of the installation faced a number of important considerations in selecting the coils for the plant's primary and secondary condensers.

First, the condenser tubes had to be heavy enough to pass a hydrostatic test of 7500 psi. Second, unique fabricating requirements had to be met; tube ends had to be shaped into J-bends well under the usual minimum bend radius. Third, the "standard" problems of ammonia and sea-water corrosion had to be solved. Throughout, cost was a constant consideration.

Condenser Make-Up

The condensers themselves consist of one section with fourteen parallel banks of six passes each, and a section of fourteen parallel banks of ten passes each. Each section has an inlet and outlet header.

Bridgeport Duplex Chosen

Bridgeport Duplex Tube was selected, heavy steel inside to withstand pressure and resist ammonia corrosion, and .065" inhibited Admiralty cladding on the outside to combat sea-water corrosion. Stainless steel was considered, but because of its debatable service life *and* cost, was not chosen. The cost of Cupro-Nickel and Nickel-Copper Alloy was also too high. Admiralty-clad Duplex Tubes, on the other hand, have an estimated life of eight years—plus.

Precise Fabrication Problems

The near-mile of tube that went into both condenser coils was supplied in 22-foot lengths and was formed into finished coils by Portland Copper and Tank Works, Inc., So. Portland, Maine. One end of each tube had to be bent to a 4-7/16" radius, a job so precise that a special bending die was designed and built for the job.

Joining the bent tube lengths into finished coils involved stripping back the Admiralty cladding two inches from the end of each tube length. The exposed steel tube ends then were welded together and the weld surface ground smooth with the OD of the tube. Six-inch Admiralty sleeves were slipped into place and brazed in position. Special fabricating techniques were observed throughout every step of the operation.

Bridgeport for Precise Requirements

Bridgeport Duplex Tubes, of many varieties, have a long history of service and efficiency. As in this case, they are often the *economical* answer to a number of problems. Their wide use in ammonia refrigeration systems, ammonia and synthetic rubber production, the process industries, chemical plants, the petroleum industry and coke by-products plants is an "in-service" endorsement which can be applied to your own needs.

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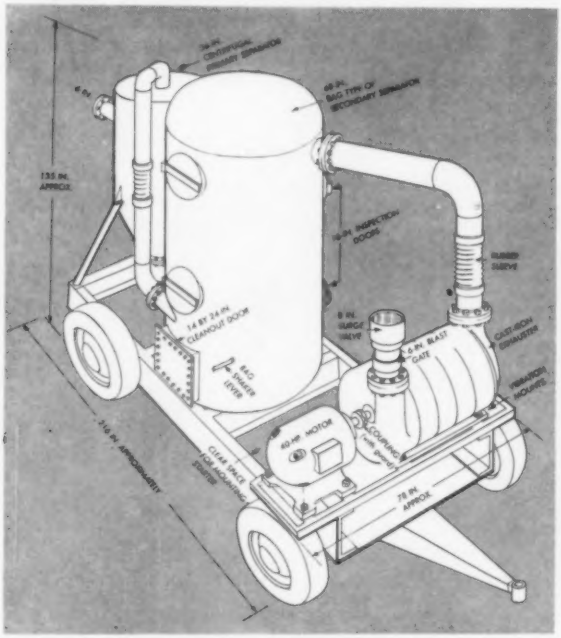

PORTABLE vacuum cleaner removes residual catalyst during cat cracker turnarounds. Primary cyclone separator is at left; secondary separator, of the inverted filter-bag type, is at center; and exhauster is at right.

PORTABLE UNIT is rolled into position and connected to the vacuum line at one of several locations on the ground level. Removal of catalyst is complete, and the cleaner contributes to a faster turnaround.

Cat cracker cleaned by vacuum

By Larry Resen
District Editor

A KING-SIZED vacuum cleaner is being used by The Texas Co. at its Port Arthur, Tex., refinery to remove residual catalyst from fluid cat crackers during turnarounds.

The vacuum cleaner is portable and is rolled into position within the unit as desired. A permanent catalyst vacuum line on the unit has been equipped with outlets at strategic levels. The vacuum cleaner is connected to this line. Maintenance crews hook onto the various outlets with flexible hoses and use these to clean the catalyst from vessels and lines of the unit.

This method provides a simple, fast means of effectively removing residual catalyst, which previously was a time-consuming task. The use of a vacuum has enabled catalyst to be removed from places which were previously inaccessible. Since there is no contaminating source, as would be the case were water used to flush out the unit, all catalyst recovered this way is suitable for reuse, and thus catalyst losses have been reduced.

The vacuum cleaner Texaco uses was made by United States Hoffman Machinery Co. It is mounted on a four-wheel, 100-in. wheelbase trailer and consists of the following major components:

1. A centrifugal exhauster designed to produce a minimum vacuum of 8-in. mercury, with a minimum of 700 cu. ft. per minute and to handle 5 tons of catalyst per hour through 6-in. F.C.C.U. vacuum lines. This exhauster is driven by a 40-hp. electric motor.

2. A secondary separator located ahead of the exhauster so only clean air passes through the centrifugal exhauster and is discharged to the atmosphere. This separator is of the inverted filter bag type.

3. A primary separator of the cyclone type through which practically all of the catalyst is recovered. This is equipped with an 8-in. automatic dump rotary valve driven by a ½-hp. electric motor.

The catalyst vacuum line extends from ground level to the top of the regenerator. From ground level to the eighth floor the line size is 6-in. from the eighth to the tenth floor it is 4-in., and the remainder is 3-in. Slip-joint piping outlets are located at vantage points on the first, fourth, sixth, eighth, tenth, and thirteenth floor levels. Vacuum hoses with 1½ or 3-in. diameters and 25-ft. lengths are connected to these outlets as required.

The vacuum unit is connected to the vacuum line at ground level. A temporary wooden bin is constructed beneath the discharge from the primary separator. This bin begins to fill once the unit has been placed in operation and cleaning progresses. The stationary, permanent catalyst vacuum car-unloading facilities are then placed in operation and the catalyst is transferred from the bin to the storage hopper.

This method has been successful in removing residual catalyst from the regenerator, precipitators, recycle catalyst lines, reactor feed lines, regenerator inlet line, and the process air line. In addition to a savings in catalyst, it contributes to a faster turnaround.

by W. L. Nelson
Technical Editor

COST-imating

37. Current Cost Indexes

THE COST INDEXES on this page may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction Cost Index is published in the first issue each month.

(Multiply the 1946 prices of the COST-imating Series by these Index Numbers divided by 100)

	1949	1952	1954	1955	1956	May 1957	References*	Index for earlier years (The Oil and Gas Journal) in Cost-imating issues
Operating costs (based on 1956 as 100.0):								
Power, electric	109.9	105.1	108.2	103.1	100.0	100.9	Code 5-4	
Fuel, residual	66.0	81.0	86.5	93.0	100.0	116.2		
Gulf cargoes	69.5	78.3	85.9	90.9	100.0	112.7		
N. Y. barges	69.6	84.9	82.6	91.2	100.0	116.0		
S. Pedro bunkers	76.9	79.8	84.3	85.9	100.0	124.3		
Oklahoma	51.2	57.1	62.0	82.4	100.0	112.0		
Industrial chemicals	80.1	95.0	96.9	97.4	100.0	101.9		
Phos. acid	86.7	93.9	96.6	97.5	100.0	100.0	Code 6-11-07	
Sulf. acid	76.1	89.5	100.0	100.0	100.0	100.0	Code 6-11-09	
Ammonia	104.8	94.6	103.0	103.0	100.0	97.0	Code 6-11-13	
Lime		87.7	92.0	93.5	100.0	106.3	Code 6-11-29	
Sod. carbonate	76.7	84.5	92.9	94.3	100.0	104.1	Code 6-11-65	
Sod. hydroxide	73.5	80.6	90.9	94.3	100.0	103.4	Code 6-11-69	
Sod. phosphate	85.3	92.0	95.5	95.5	100.0	100.0	Code 6-11-71	
Furfural		93.6	100.0	100.0	100.0	100.0	Code 6-12-63	
MEK		94.5	94.5	94.5	100.0	103.3	Code 6-12-72	
Phenol		110.6	90.4	92.9	100.0	103.1	Code 6-12-83	
TEL	95.9	105.4	102.8	98.6	100.0		Supplier	
Operating labor	69.5	81.5	88.7	92.6	100.0	103.3	Employ. and earn.	No. 55—Nov. 3, 1949
Productivity	85.5	90.2	97.1	102.2	100.0	99.6	Employ. and earn.	Sept. 24, 1958§
Construction labor (1946 = 100):								
Skilled construction	133.9	157.9	174.6	179.8	187.3	193.8	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	140.4	168.2	192.1	199.4	209.2	218.4	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	137.1	163.1	183.3	189.6	198.2	206.1		No. 61—Dec. 15, 1949
Equipment or materials (1946 = 100):								
Arc-welding machinery	130.5	151.3	158.4	163.8	180.2	185.4	Code ‡11-76	May 2, 1955§
Boilers, tanks, and sheet metal	†134.8	†153.4	147.3	150.3	168.0	174.8	Code 10-72	April 21, 1952§
Building materials (nonmetallic)	151.2	134.8	143.6	149.4	154.0	160.4	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	127.7	140.6	144.7	150.5	159.2	161.1	Code 13-41	No. 20—Mar. 3, 1949
Brick—fireclay	139.8	167.1	193.1	205.9	218.1	235.8	Code 13-42	May 30, 1955§
Castings (foundry products)	150.5	168.0	181.1	185.1	204.7	216.7	Code 10-15	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	126.0	145.8	159.1	167.4	176.9	185.2	Code 13-4	No. 20—Mar. 3, 1949
Concrete—ingredients	123.7	132.7	142.1	146.6	153.3	159.3	Code 13-2	No. 22—Mar. 17, 1949
Concrete—products	121.7	132.6	138.5	139.8	144.9	149.4	Code 13-3	
Electric machinery	130.9	152.4	159.9	162.5	175.0	187.8	Code ‡11-7	May 2, 1955§
Motors and generators	128.7	154.6	157.7	157.1	169.6	180.7	Code ‡11-73	No. 31—May 19, 1949
Switchgear	132.3	161.4	171.2	176.5	194.9	210.2	Code ‡11-75	May 2, 1955§
Transformers	129.7	148.0	161.9	161.8	175.4	186.7	Code ‡11-74	No. 31—May 19, 1949
Engines (composite)	124.8	146.5	150.5	153.2	164.0	173.5	Code ‡11-54	No. 36—June 23, 1949
Exchangers	133.0	165.8	174.5	156.8	193.4	209.6	Manufacturer	No. 2—Oct. 28, 1948
Copper base		175.3	182.0	164.3	198.8	190.0	Manufacturer	
Steel		152.3	149.0	145.3	178.6	224.0	Manufacturer	
Fans and blowers	152.2	183.7	192.6	199.7	222.4	235.8	Code 11-47	Feb. 17, 1949§
Hand tools	134.0	155.1	173.8	185.7	200.3	211.6	Code 10-42	June 27, 1955§
Instruments (composite)	128.1	146.2	154.6	162.9	182.1	286.2	Manufacturer	No. 34—June 9, 1949
Flow meter (mechanical)	109.2	132.3	161.6	177.2	203.5	203.3	Manufacturer	No. 34—June 9, 1949
Flow meter (air control)	132.4	160.5	179.6	188.6	203.9	208.2	Manufacturer	No. 34—June 9, 1949
Flow meter (remote)	130.2	155.2	146.5	153.5	170.2	170.2	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	125.8	151.5	167.2	178.6	211.8	229.1	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	131.6	144.9	150.5	164.0	192.3	202.7	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	130.2	158.4	166.3	169.1	187.1	187.1	Manufacturer	No. 34—June 9, 1949
Pressure gage	100.0	108.6	108.6	112.1	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	118.6	149.4	152.8	156.5	170.2	170.2	Manufacturer	No. 34—June 9, 1949
Control valve	129.8	155.5	162.0	166.8	180.9	185.5	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	165.3	203.2	197.8	209.7	214.5	203.3	Code 8-1	No. 7—Dec. 2, 1948
Southern Pine	157.7	191.2	181.2	188.4	195.0	187.8	Code 8-12	No. 7—Dec. 2, 1948
Other soft woods	203.9	248.5	252.7	265.1	266.5	260.7	Code 8-13	No. 7—Dec. 2, 1948
Machinery—general purposes	131.9	151.8	159.9	166.8	183.8	194.5	Code 11-4	Feb. 17, 1949§
Machinery—construction	136.0	157.5	165.9	172.5	187.4	198.7	Code 11-2	
Machinery—oil fields	†132.9	†149.9	†161.9	†168.5	†179.3	187.1	Code 11-51	Oct. 10, 1955§
Paints—prepared	142.8	155.7	159.0	161.4	169.2	175.8	Code 6-21	May 16, 1955§
Pipe, sewer	†119.3	136.9	140.1	149.9	160.5	168.6	Code 13-45	No. 22—Mar. 17, 1949
Pipe, black iron	152.2	179.0	195.0	204.0	233.0	250.7	Code 10-14-56	No. 19—Oct. 15, 1956
Pipe, 6-in. line	†152.0	†174.0	†200.5	†211.8	†241.2	262.9	Code 10-14-58	May 4, 1957§
Pumps, air compressors, etc.	135.9	155.6	166.5	177.2	192.0	203.7	Code ‡11-41	No. 29—May 5, 1949
Steel (iron and steel)	143.3	168.5	179.6	189.9	209.0	220.1	Code 10-1	No. 61—Dec. 15, 1949
Steel—finished steel	173.8	170.0	187.1	196.0	212.4	228.5	Code 10-14	July 25, 1955§
Plate	142.1	163.1	187.0	195.1	215.9	239.1	Code 10-14-26	Mar. 4, 1957§
Structural shapes	152.2	176.2	193.4	204.3	219.1	246.7	Code ‡10-14-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	140.9	168.8	199.4	211.2	235.5	260.2	Code 10-14-61	Sept. 5, 1955§
Valves and fittings	†132.9	190.8	197.1	208.6	231.9	240.2	Code ‡11-49 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction	139.6	163.6	179.8	184.2	195.3	203.6		No. 61—Dec. 15, 1949

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices." †Estimated base value for 1946. ‡Not exactly the same items as those published before July 7, 1952. §Questions on Technology, The Oil and Gas Journal. ¶Preliminary.

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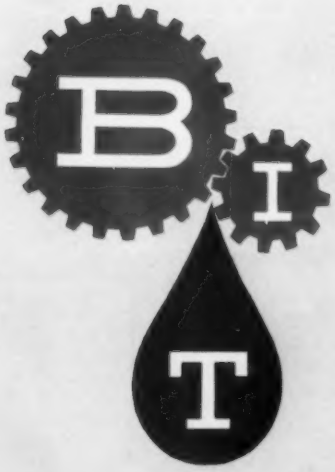

MONTGOMERY, ALABAMA
DALLAS, TEXAS
TULSA, OKLAHOMA
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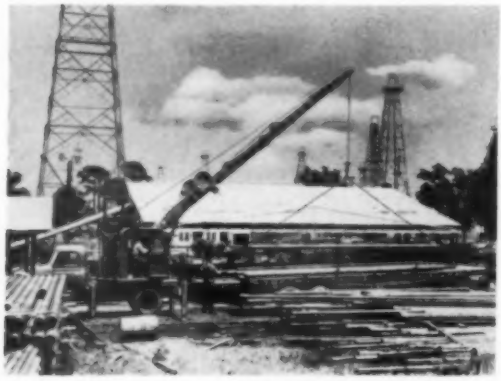
• A 15-ton Bucyrus-Erie 15-B Transit Crane lifts heavy steel pipe in a storage yard near an oil field.



• Handling awkward loads in and around sheds comes easy to this 5-ton Bucyrus-Erie H-3 Hydrocrane with its telescoping boom, quick-set outriggers and precision hydraulic control. Open-road speeds up to 50 mph mean less between-job travel time, more on-the-job profit-making time. The H-5 Hydrocrane has a 10-ton capacity.

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is their spice of life

Around field sites, team tracks and storage yards, Bucyrus-Erie Transit Cranes are ideally suited to handle a variety of jobs. Fast between-job travel adds to the usefulness of these cranes — the 15-ton Model 15-B, 25-ton Model 22-B and new 35-ton Model 30-B.

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These features and many others that are standard on Bucyrus-Eries are "extra" at additional cost on other cranes. For complete details on these Transit Cranes as well as 5- and 10-ton Hydrocranes, see your Bucyrus-Erie distributor today. 382E57

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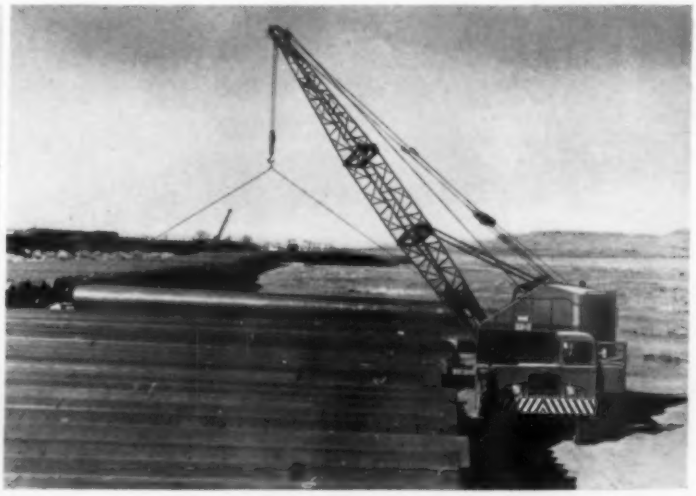
• A Bucyrus-Erie 35-ton 30-B Transit Crane lifts 48-in. concrete pipe from a truck.



• Next to a railroad, a 25-ton Bucyrus-Erie 22-B Transit Crane stacks bulky pipe in neat rows.

Pipeline Patrol

...Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way.

U.S. Crude-Oil Pipelines

• **Belle Fourche Pipeline Co.**
Project: 30 miles of 6-in. from Donkey Creek pool to Fiddler Creek pool in northeastern Wyo. Will later build a line from Fiddler Creek to connect with Butte Pipe Line Co. near Osage, Wyo.
Status: Planned.

• **Cape Pipe Line Co.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.)
Project: Line from lower Delaware Bay to Philadelphia.
Status: Long range plans.
Completion: 1960.

• **Forest Pipeline Corp.**
Project: 35 miles of 8-in. from Grieve field, Wyoming, to Platte Pipe Line at Casper.
Status: Under way.
Completion: Fall 1957.

• **Four Corners Pipe Line Co.** (Shell, Standard of Calif., Continental, Gulf, Richfield, Superior)
Project: 635 miles of 16-in. from Aneth field in southern Utah to Los Angeles, 86 miles of 12-in. from New Mexico's Bisti field to Red Mesa station 35 miles southeast of Bluff, Utah, and 3 miles of 6, 8, 10-in. feeder lines from other fields in New Mexico and Utah. Will be operated by Shell Pipe Line.
Status: Under way.
Contractor: **A. P. Vaughn Construction Co.** and **Potashnick Construction Co.** have 170 miles of 16-in. from Aneth field to Cameron, Ariz. **R. H. Fulton Construction Co.** has 98 miles of 16-in. from Cameron to Seligman, Ariz., and 217 miles of 16-in. from the Colorado River to Olive, Calif. **Vaughn and Potashnick** have 100 miles of 16-in. from Seligman to the Colorado River; **Pacific Pipeline Co.**, 46 miles of 16-in. from Olive to Los Angeles; **Standard Pipeline Construction Co.**, feeder lines to Utah and New Mexico fields.
Completion: End 1957.

• **Great Northern Railway Co.**
Project: 400 to 600 miles of 12 to 20-in. from Williston basin in Montana and North Dakota, to Clearbrook or St. Paul, Minn.
Status: Under study.
Contractor: **Pipe Line Technologists, Inc.** has contract for feasibility study.

• **Interstate Oil Pipe Line Co.**
Project: 5 miles of 4-in. from South Bosco field, and 5 miles of various size from Church Point field, La., to present main line.
Status: Proposed

• **Magnolia Pipe Line Co.**
Project: 24 miles of 20-in., 20 miles of 12-in., 83 miles of 16-in. from Corsicana to Clyde, Tex.
Status: Under way.
Contractor: **H. B. Zachry Co.**
Completion: November 1, 1957.
Project: 120 miles of 16-in., 4 miles of 12-in. from Clyde to Midland, Tex.
Status: To start September 15, 1957.
Contractor: **O. R. Burden Construction Corp.**
Completion: December 31, 1957.

• **Muskegon Pipe Line Corp.** (Aurora Gasoline Co., Service Pipe Line Co.)
Project: 165 miles of 10-in. from Griffith, Ind., to Muskegon, Mich.
Status: Under way.
Contractor: **Midwestern Constructors, Inc.**
Completion: Late 1957.

• **Northwest Pipeline Corp.**
Project: 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.
Status: Proposed.

• **Offshore Gathering Corp., Houston.**
Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)
Status: Proposed.

• **Oil Field Pipe Line, Inc.**
Project: 200 miles 8 and 12-in. line from near Elkhart, to Ellinwood, Kans.
Status: Proposed.

• **Salt Lake Pipe Line Co.**
Project: 93 miles of 10-in. loops from Rangely, Colo., to Salt Lake City.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.** has 93 miles between Rangely field and Salt Lake City.
Completion: December 1, 1957.

• **Shell Oil Co.**
Project: Undetermined length of 3, 4-in. in South Louisiana.
Status: Under way.
Contractor: **Brown & Root, Inc.**, W. P. Stanley, spread superintendent, office at Buras, La.
Completion: September 30, 1957.

• **Sinclair Pipeline Co.**
Project: 150 miles of 20-in. from Teague Tex., to Houston.
Status: Planned for 1958
Completion: 1958.

• **Skelly Oil Co.**
Project: 38 miles of 8-in. extension of its gathering system into southern Kiowa County, Kansas.
Status: To start in September.
Completion: Early fall 1957.
Project: 50 miles of 12-in. to replace partially looped 6, 8-in. line between Cunningham and Burton, Kans.
Status: To start as soon as pipe is received.
Completion: Late 1957.

• **Southern Kansas Pipeline, Inc.**
Project: 200 miles of 6 to 10-in. in Kans. from southwestern Meade County to 10 miles north of Arkansas City.
Status: Proposed. Request filed with Kansas Corporation Commission for permit.

• **Tecumseh Pipe Line System** (Sinclair Pipe Line, Ashland, Pure)
Project: 201 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio.
Status: Under way.
Contractor: **O. R. Burden Construction Corp.** and **Morrison Construction Co.**
Completion: September 1957.

• **Texas-New Mexico Pipe Line Co.** (Sinclair, Texas Co., Tidewater, Empire)
Project: 515 miles of 16-in. from southeast corner of Utah to Jal, N. M.
Status: To start late 1957.
Completion: 1958.

U.S. Products Pipelines

• **Alaska-Yukon Refiners & Distributors, Ltd.**
Project: Two lines: one 150 miles from Haines to Haines Junction, Alaska, linking with government Canol line; another from

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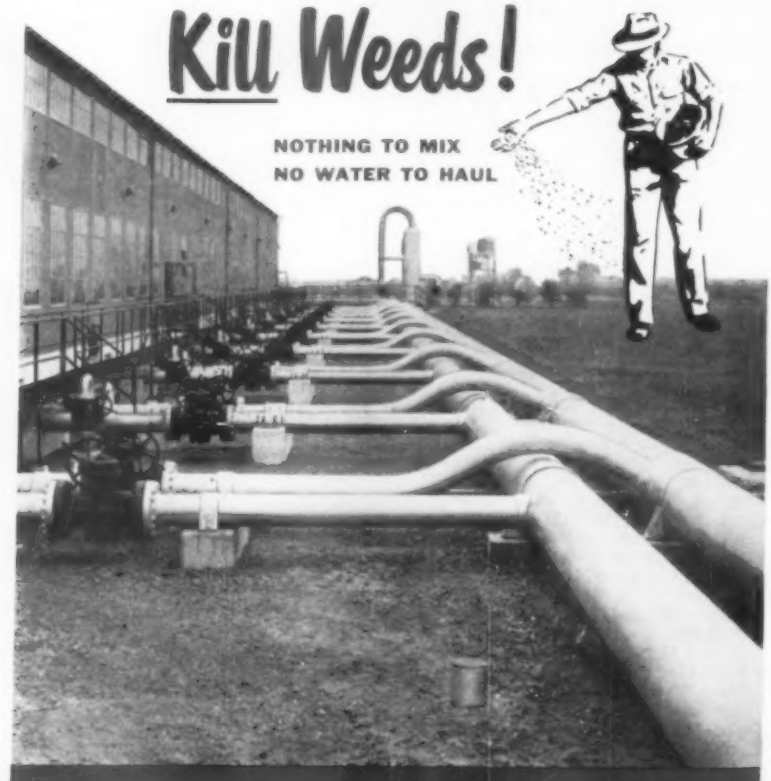

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Pipeline Patrol

Fok Junction, on Canol line, to Anchorage.
Status: Proposed.
Completion: 1959.

• **American Pipe Line Co.**
Project: Line from Gulf Coast to New York City. Has ODM approval to amortize 40 per cent of cost with fast writeoff.
Status: Proposed.

• **Buckeye Pipe Line Co.**
Project: Conversion of 32 miles of 8-in between Mantua and Youngstown, Ohio.
Status: Planned.
Contractor: Company will do own work
Completion: November 1957.
Project: 70 miles of 8-in. from Wayne to vicinity of Durand, Mich.
Status: Under way.
Completion: Early 1958.
Project: 60 miles of 10-in. from Port Everglades, Fla., to Miami's International Airport.
Status: Under way.
Contractor: Buckeye will do own work.

• **Cities Service Pipe Line Co.**
Project: 30 miles of 6-in. ethylene line from Lake Charles. La., to Orange, Tex.
Status: Under way.
Completion: October 1, 1957.
Project: 168 miles of 6-in. L.P.G. line from East Chicago, Ind., to Lowell, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.** has 98 miles from Lowell to South Bend. Ind., Robert Hively, spread superintendent office at Ada, Mich. **M. L. Hulcher Co., Inc.** has 53 miles from South Bend to East Gary, Ind.
Completion: September 1957.

• **El Paso Natural Gas Co.**
Project: 11 miles of 4-in. L.P.G. from Snyder Line to South Andrews Plant, Tex.
Status: Planned
Project: 240 miles of 6-in. from Odessa to El. Paso, Tex.
Status: Under way.
Contractor: **Pipeline Engineering Co.** has design and engineering contract. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contracts.
Completion: March 1, 1958.

• **Emerald Pipe Line Corp.**
Project: 120 miles of 6-in. from Sunray, Tex., to Tucumcari, N. M.
Status: Plannned.
Completion: December 1, 1957.

• **Florida Pipeline & Storage Co.**
Project: 67 miles from Everglades, Fla., to Homestead Air Force Base south of Miami.
Status: Under way.
Contractor: **Fish Service Corp.**
Completion: December 1957.

• **Great Lakes Pipe Line Co.**
Project: 93 miles of 8-in. from south of St. Paul to Eau Claire, Wis.; 68 miles of 12-in. from Great Lakes intersecting point with Badger Pipe Line to Chicago.
Status: Under way.
Contractor: **R. H. Fulton & Co.** has the 8-in. **Midwestern Contractors, Inc.,** has 20 miles of 12-in. in Chicago area and **M-R Co.** has 48 miles of 12-in. from Badger system east.
Completion: Late 1957.
Project: 15 miles of 6-in. from Lincoln, Neb., to Lincoln air base.
Project: 140 miles of 8-in. from Minneapolis to Superior terminals.
Status: Under way.
Contractor: **Laco Pipeline Contractors, Inc.**
Project: 34 miles of 12-in. from Tulsa to Barnsdall, Okla., replacing 12, 8-in. lines
Contractor: **Midwestern Constructors, Inc.**
Completion: Late 1957.
Project: 14 miles of 8-in. from Coffeyville

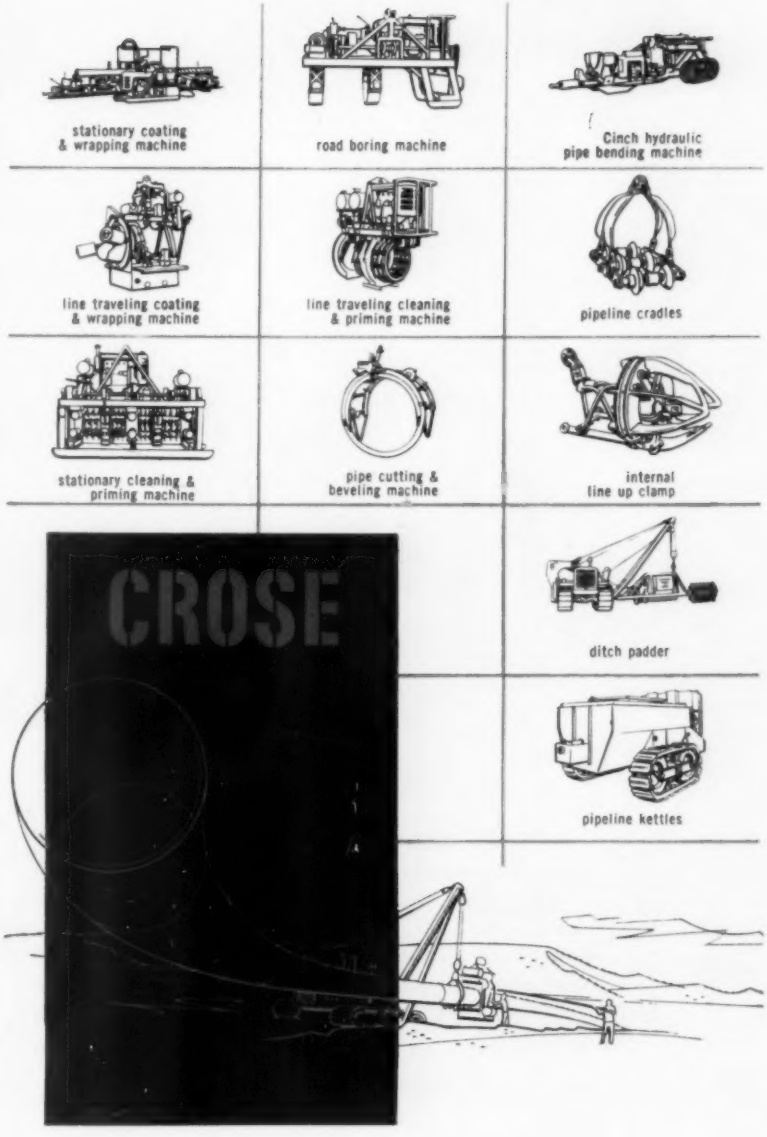
Pipeline Patrol

to Independence, Kans., replacing 4-in. line
Contractor: **Jess Whitlow Pipe Line Service**
Project: 11 miles of 8-in. from 10 miles east of Donahue, Iowa, to terminals at Bettendorf, Iowa.
Contractor: **R. T. Perry Pipe Line Construction.**

- **Laurel Pipeline Co.** (Gulf Refining Co. Sinclair Pipe Line Co., The Texas Co.)
Project: 100 miles of 24-in. and 340 miles of line graduating down to 14-in. at the west terminus, from Philadelphia to Cleveland.
Status: To start early 1958.
Completion: 1958.
- **Leonard Refineries, Inc.**
Project: 43 miles of 6-in. from Alma to Lansing, Mich.
Status: Planned.
Completion: Late fall 1957.
- **Northwest Pipeline Corp.**
Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.
Status: Proposed.
- **Ohio Oil Co.**
Project: 350-miles of 12-in. from Wood River, and Robinson, Ill., to Chicago.
Status: Under way.
Contractor: **Panama-Williams Corp.** has 84 miles from Robinson to Champaign.
Completion: 1958.
- **Salt Lake Pipe Line Co.**
Project: 80 miles of 8-in. loops from Adams to Ontario, Ore.
Status: Under way.
Contractor: **Hallmac Construction Co.**
- **Texas Eastern Transmission Corp.**
Project: 231 miles of 14-in. from Seymour, Ind., to Chicago.
Status: Under way.
Contractors: **H. L. Gentry Construction Co.,** has 84 miles starting at Seymour; **Latex Construction Co.** the next 93.1 miles; **Western Pipeline, Inc.,** the next 38.6 miles.
Completion: September 1957.
- **Trust Pipe Line Co.** (Cosden Petroleum)
Project: 138 miles of 6-in. from Hawley, near Abilene, to Wichita Falls, Tex.
Status: Under way.
Contractor: **Holder Construction Co.**
Completion: October 15, 1957.
- **Underground Storage & Exploration, Inc.**
Project: 393 miles of 12-in. L.P.G. line from Moundsville, W. Va., to Newark, N. J., plus 95 miles of 6, 8-in. laterals to Mauch Chunk, Pa., and to Philadelphia.
Status: Proposed.
- **Union Oil Co. of California**
Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its Rifle shale-oil plant.
Status: Proposed.

U.S. Natural-Gas Pipelines

- **Arkansas Louisiana Gas Co.**
Project: A 300-mile line, plus gathering lines, from Tex.-La. coastal area to northern La., to connect with present system.
Status: Long-range plans.
- **Atlantic Seaboard Corp.**
Project: 6 miles of 26-in. from Petersburg to Moorefield, W. Va.
Status: Has temporary FPC approval.
Contractor: **Williams-Austin Contsruction Co.**
Completion: November 1957.
- **Carolina Pipeline Co.**
Project: 177 miles of 2, 3, 4, 6, 8, and 10-in. between Blacksburg and Camden, S. C.
Status: Under way.
Contractor: **Panama-Williams Corp.** has construction contract. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contract.
- **Central Hudson Gas & Electric Corp.**



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Pipeline Patrol

Project: 46 miles of 10-in. from Albany to Kingston, N. Y.
Status: Under way.
Contractor: **Williams-Austin Construction Corp.,** O. L. Martin and Ralph Gaddy, supts., office at Catskill, N. Y.
Completion: December 1, 1957.

- **Cities Service Gas Co.**

Project: 8 miles of 16-in., 20 miles of 8-in., 20 miles of 6-in., and 20 miles of 4-in. field lines in Barber County, Kansas.
Status: Under way.
Contractor: **Vaughn & Taylor Construction Co.**

Project: 3 miles of 12-in., 8 miles of 10-in., 4 miles of 8-in., 8 miles of 6-in., and 37 miles of 4-in. field lines in Eureka Field, Okla.
Status: Under way.
Contractor: **Prairie Construction Co.**

Project. 64 miles of 6 to 30-in. in Leavenworth and Anderson counties, Kans., Cass County, Mo., and Oklahoma County, Okla.
Status: Planned.

Project: 75 miles of 30-in. from Independence to near Welda, Kan.
Status: Pending FPC approval.

Project: 7 miles of 30-in. from Merriam to Kansas City, Kans.
Status: Under way.
Contractor: **Prairie Construction Co., Inc.**
Completion: September 15, 1957.

- **Coastal States Gas Producing Co.**

Project: A 20-mile gathering system from the Rock Island area of Colorado County, Tex., to the United Gas Corp. system.

- **Coastal States Gas Producing Co.** and **Southern Coast Corp.**

Project: 45 miles of 2 to 10-in. in Bee County, Tex. to connect presently shutin fields with Texas Eastern Transmission Corp.'s system.
Status: Planned.

- **Coastal Transmission Corp.**

Project: 575 miles of 12, 20, 22, 24-in. main line and 414 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.
Status: Under way.
Completion: January 1, 1958.

- **Colonial Natural Gas Corp.**

Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.
Status: Proposed.

- **Colorado Interstate Gas Co.**

Project: 1957 program . . . 66 miles of 10-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 50 miles of 22-in. from Laverne to Hooker, Okla.; 24 miles of 22-in. Panhandle field looping.
Status: Pending FPC approval. Has temporary approval for the 50 miles in Okla.

- **Eastern Shore Natural Gas Co.**

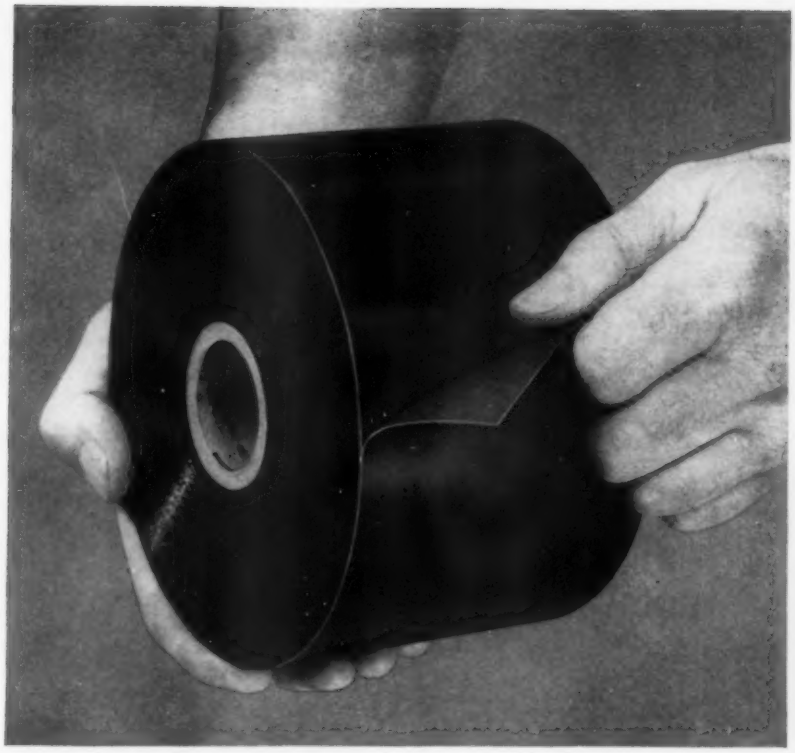
Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp. in Maryland, across entire length of Delaware to Salisbury.
Status: Pending FPC approval.

- **East Ohio Gas Co.**

Project: 90 miles of 24-in., and 23 miles of 30-in. from Richfield to Summerfield, Ohio.
Contractor: **Sharman, Allen, Gay & Taylor, Inc.,** James Adams, spread superintendent, office at Wadsworth, Ohio. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contract.
Completion: November 1957.

- **Edison Securities Co.**

Project: 130 miles of 30-in. from San Joaquin Valley fields to Wilmington, Calif.
Status: Being contested by Southern Cali-



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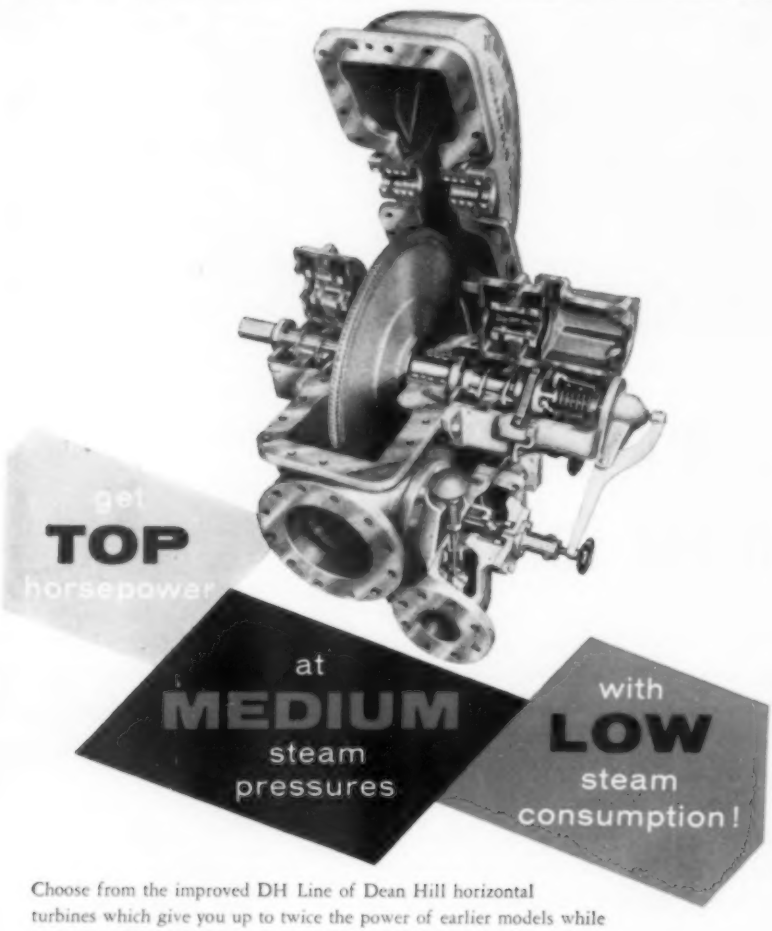
Pipeline Patrol

fornia Gas Co., Southern Counties Gas Co., and Pacific Lighting Gas Supply Co.
Contractor: **Bechtel Corp.**

• **El Paso Natural Gas Co.**
Project: 27 miles of 34-in. San Juan main line loops.
Status: Under way.
Completion: September 1957.
Project: 81 miles of 18-in. and 13 miles of 20-in. from Panoma Plant, Gray County, to Dumas Plant, Moore County, Texas.
Status: Under way.
Contractor: **R. H. Fulton & Co. Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contract.
Completion: November 1, 1957.
Project: 177 miles of 20-in. from Sonora Plant, Sutton County, to Plains Plant, Yoakum County, Texas.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 74 miles of 30-in. Permian-San Juan main line loops.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 216 miles of 6 to 34-in. and 533 miles of various size in Ariz., Tex., N. M.
Status: Filed for FPC permit.
Project: 47 miles of 30-in. from proposed Lindrith, N. M., plant to proposed Chaco, N. M., plant.
Status: Under way.
Contractor: **Foutz & Bursum Construction Co.**
Completion: 1957.



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Project: 38 miles of various size line to make additional gas available at the McElroy-Wilshire plant near Crane, Tex.
Project: 500 miles of 34-in. from Twin Falls, Idaho to California border near Las Vegas, Nev.
Status: Planned.
Completion: September 1959.

• **Houston Texas Gas & Oil Corp.**
Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 139 miles of 18-in. and 101 miles of 20-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line to join Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.
Status: To start November 1.
Contractor: **Midwestern Constructors has the 702 miles of 24-in.; Harbert Construction Corp.** has remainder.
Completion: June 1958.

• **Intermountain Gas Co.**
Project: 16 miles of 6-in. from Payette to Weister, Ida.
Contractor: **Hood Construction Co.**, V. H. Bailey, supt., office at Payette.
Completion: September 15, 1957.

• **Iron Ranges Natural Gas Co.**, St. Paul.
Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.
Status: Application pending with FPC.

• **Kansas-Nebraska Natural Gas Co.**
Project: 61 miles of various size gathering line in Camerick field, Texas County, Okla.
Status: Approved.

• **Manufacturers Light & Heat Co.**
Project: 50 miles of 10, 12-in. from Waynesburg to Pittsburgh, Pa.; 40 miles of 16-in. and 20 miles of 6 to 12-in. from Corning to Dundee, N. Y.
Status: Under way.
Contractor: **Harford Brothers**, A. M. Harford and Robert Mann, superintendents.
Completion: September 15, 1957.

• **Michigan Consolidated Gas Co.**
Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.**; Floyd Huduall, supt., office at Cadillac.
Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.**, jointly with **H. L. Gentry Construction**; Frank Morris, superintendent, office at Hart, Mich.

• **Midwestern Gas Transmission Co.**
Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., plus 648 miles of 3 to 18-in. extensions in Minn. and Wis.
Status: Application pending with FPC.

• **Mississippi River Fuel Corp.**
Project: 54 miles of 26-in. loops between Perryville, La., and Columbia, Ill.
Status: Under way.
Contractor: **Cape Construction Co., Inc.**
Completion: November 15, 1957.

• **Montana-Dakota Utilities Co.**
Project: 28 miles of 12-in. from Fallon County to Dawson County, Montana.
Status: Approved.
Project: 6 miles of 12-in. between Mandan and Bismarck, N. D.
Status: Has temporary approval.

• **Mountain Fuel Supply Co.**, Salt Lake City.
Project: 38 miles of 20-in. to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.
Status: Under way.
Completion: September 1957.
Project: Extension of 12-in. line from Ogden to Logan and Brigham City, Utah.
Status: Has applied to Utah Public Service Commission.
Completion: Late 1957.

Pipeline Patrol

• **Natural Gas Pipeline Co. of America**

Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch Tex., plus a gathering system.

Status: Under way.

Contractor: **R. H. Fulton & Co.** has Red River crossing in northern Montague County **Fulton & Brodie, Inc.,** has gathering system. **Eastern Pipeline Contractors,** Dallas has 80 miles of 20-in. from Bridgeport, Tex., to Healdton, Okla. **River Construction Corp.** has 173 miles from Mountain View, Okla., to Fritch, Tex. **H. B. Zachry Co.** has 87 miles of 26-in. between Healdton and Mountain View, Okla.

Completion: January 1, 1958.

Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and 91 miles of 30-in. loops along parts of its main line.

Status: Application pending with FPC.

Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 36-in. between Beatrice and Joilet, Ill., along existing system.

Status: Pending FPC approval.

Completion: 1959.

• **New York State Natural Gas Corp.**

Project: 31 miles of 20-in. from Harrison to Woodhull, N. Y.; 10 miles of 12-in. from Stockbridge to Oneida, N. Y.

Status: Planned.

Project: 12 miles of 12-in. near Oneida, N. Y.

Status: To start September 15, 1957.

Contractor: **Harford Brothers,** has the 12-in., A. M. Harford and Robert Mann, superintendents. **Pavilion Pipe Line Corp.** has the 20-in.

Completion: October 15, 1957.

• **Niagara Mohawk Power Corp.**

Project: 14 miles of 18-in. from Phoenix to Palermo, N. Y.

Status: Under way.

Completion: October 1, 1957.

Project: 196 miles of 2 to 16-in. transmission and distribution mains to service areas in central, eastern and northern New York.

Status: Planned.

Contractor: Various.

Completion: December 31, 1957.

• **North Carolina Natural Gas Corp.**

Project: 630 miles of 2 to 16-in. from near Mooresville, eastwardly across N. C.

Status: To start fall 1957.

Completion: Spring 1958.

• **Northern Natural Gas Co.**

Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.

Status: Under way.

Contractor: **Troth Construction Co.**

Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.

Status: Planned.

Project: 365 miles of main line and 1,090 miles of branch lines to serve communities in Minn., Iowa, S. D., Nebr., Wis.

Status: Filed with FPC March 18, 1957.

Project: 85 miles of 24 and 30-in. loops between Sunray, Tex., and Sioux City, Iowa.

Status: To start September 1957.

Contractor: **R. H. Fulton & Co.**

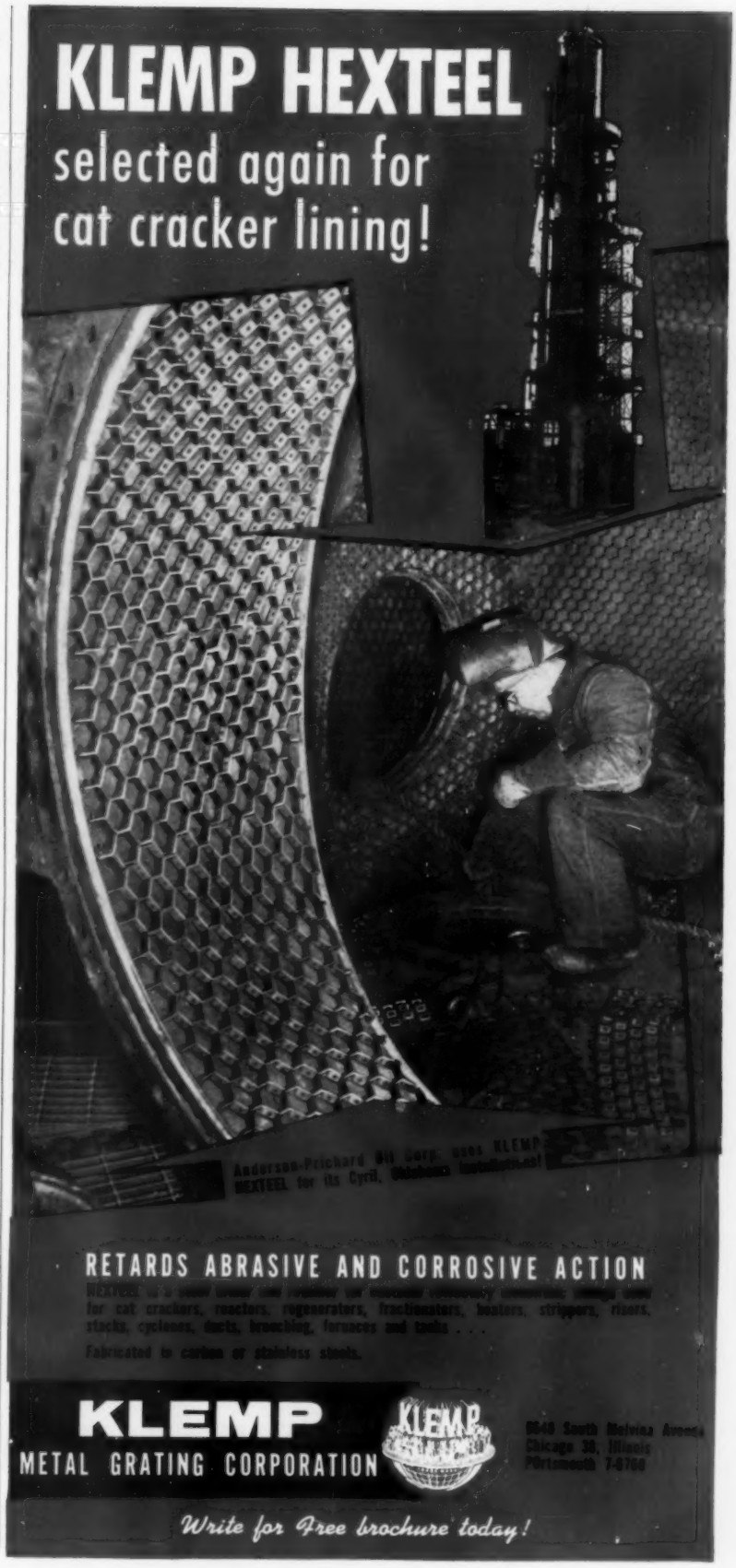
Completion: December 1957.

Project: 13 miles of 16-in. to replace existing 10-in. line in Hansford County, Texas.

Status: Has temporary FPC authority.

• **Northern Utilities Co.**

Project: 35 miles of 16-in. in Fremont-Natrona County, Wyo., area; 8 miles of 12-in. around Casper; 6 miles of 8-in. from Sand



Pipeline Patrol

Draw gas field to Beaver Creek field; 12 miles of 6-in. from Beaver Creek field to the system servicing the Riverton-Lander area.
Status: Planned.

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)
Status: Application pending with FPC.

• **Ohio Fuel Gas Co.**
Project: 11 miles of 18-in. and 11 miles of 20-in. from Gibsonburg, Ohio to Toledo; and 30 miles of 24-in. looping from Pavonia to Attica, Ohio.
Status: Under way.
Contractor: **H. L. Gentry Construction Co.** has the 18 and 20-in.
Completion: Gentry work to be completed September 20; remainder November 25, 1957.
Project: 152 miles of line in Ohio: 43 miles of 24-in. from Crawford Station to Utica; 18 miles of 24-in. from Pavonia Station to Line D; 6 miles of 20-in. from Mount Gilead to Claridon; 4 miles of 20-in. near Dayton; 4 miles of 20-in. near South Charleston; 7 miles of 16-in. near Springfield; 6 miles of 20-in. nnear Oberlin; 17 miles of 20-in. from Oak Hill to Symmes Station; 7 miles of 12-in. from Mount Sterling to Bloomingburg; 2 miles of 8-in. near Bellefontaine; 3 miles of 12-in. near Mansfield; 4 miles of 12-in. near Lakeville; 7 miles of 8-in. in Guernsey and Belmont counties.
Status: Under way.
Contractor: **O. R. Burden Construction Corp.** has completed 43 miles of 24-in. from Sugar Grove near Crawford station, to Utica, Ohio, and 27 miles of 20-in. south from Wellston.

• **Pacific Gas & Electric Co.**
Project: 138 miles of 34-in. looping of the Topock-Milpitas line.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Completion: December 1, 1957.
Project: 5 miles of 16-in., 160 miles of 12-in., 8 miles of 6-in. from Corning to Eureka, Calif.
Status: Planned.
Contractor: **Engineers Limited Pipeline Co.** and **Alex Robertson Co.**
Completion: January 1, 1958.
Project: 13 miles of 12-in., 2 miles of 10-in., from Santa Cruz to Davenport, Calif.
Status: Planned.
Completion: October 1957.
Project: 1,300 miles of 36-in. from Alberta to San Francisco.
Status: Proposed.
Completion: 1960.

• **Pacific Northwest Pipeline Corp.**
Project: 35 miles of 6, 4-in. lateral from Rainier to Olympia, Wash.
Status: Under way.
Contractor: **Midwestern Construction Co.**
Completion: October 1, 1957.
Project: 36 miles of 6-in. lateral from Coeur d'Alene to Kellogg, Idaho.
Status: Under way.
Contractor: **Hallmac Construction Co.**
Completion: October 1, 1957.

• **Pennsylvania Gas Co.**
Project: 23 miles of 10-in. in Erie County, Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pa., 30 miles of branch lines, several small distribution lines.
Status: Has FPC permit.

• **Peoples Natural Gas Co.**
Project: 58 miles of 2 to 14-in. extension and replacement lines in Pennsylvania.
Status: Under way.
Completion: September 1957.

• **Permian Basin Pipeline Co.**
Project: 83 miles of 16-in. from its Spraberry station in Midland County, Tex., to tie in with Pioneer Gathering System, Inc. in northwestern Schleicher County, Tex.
Status: Under way.
Contractor: **Lone Star Constructors,** H. A. (Red) Wylie, supt.
Completion: November 1957.

• **Phillips Petroleum Co.**
Project: 3 miles of 24-in. in Moore County Texas.
Status: Planned.
Completion: October 1, 1957.
Project: 30 miles of 3 to 8-in. in Moore Hutchinson, Sherman, Hansford, and Gray counties, Tex., and in Texas County, Okla.
Status: Planned.
Contractor: Various.
Completion: January 1, 1958.

• **Piedmont Gas Co.**
Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell and Burke counties.
Status: Has FPC approval.

• **Pioneer Gathering System, Inc.**
Project: 70 miles of mostly 16, 12-in. in Val Verde, Schleicher, Sutton counties, Tex.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Competion: Early fall 1957.

• **Shamrock Pipe Line Corp.**
Project: 2 miles of 12-in., 9 miles of 10-in., 10 miles of 8-in., 5 miles of 6-in., 3 miles of 4-in. in Dallas and Sherman counties, Tex.
Status: Planned.
Completion: October 1, 1957.

• **Signal Oil & Gas Co.**
Project: 80 miles of gathering lines to Tioga, N. D., gasoline plant from South Blue Buttes, Antelope, and North Blue Buttes, McKenzie County, N. D.
Status: Under way.
Contractor: **C. P. Bartley & Son.**
Completion: October 1, 1957.

• **Southern Natural Gas Co.**
Project: 10 miles of 8-in. laterals in Napoleonville Field and Fort Jackson Field, La.
Status: Has FPC approval.
Completion: December 1, 1957.
Project: 32 miles of 6-in. from Chandeleur Sound area, Breton Island, La.; 7 miles of 8-in. and 5 miles of 10-in. from Main Pass area to Olga, La.; 9 miles of 8-in. from Bastian Bay Field to Fort Jackson Field; 7 miles of 8-in. laterals in Manila Village Field.
Status: Has FPC approval.
Completion: December 1, 1957.

• **Spokane Natural Gas Co.**
Project: 400 miles of 1 through 24-in. distribution system at Spokane.
Status: Under way.
Contractor: **Hallmac Construction Co.;** W. L. Williams, supt., office at Spokane.
Completion: 1957.

• **Tennessee Gas Transmission Co.**
Project: 34 miles of 30-in. loop from near Lancaster to near Winchester, Ky.
Status: Under way.
Contractor: **Oklahoma Pipeline Constructors,** Gene Gohring, supt., office at Richmond.
Project: 10 miles of 24-in. loop near New Castle, Pa.
Status: Under way.
Contractor: **Harford Brothers Pipeline Contractors.**
Project: Triple 24-in. underwater crossing of Mississippi River near Greenville, Miss.
Status: Under way.
Contractor: **Pentzien, Inc.,** and **Collins Construction Co.**
Project: 71 miles of 26-in., 10 miles of 20-in., 16 miles of 16-in., and 10 miles of 12-in. gathering lines from near Kinder, La., southward to offshore fields in Gulf of Mexico.
Status: Under way.
Contractor: **Brown & Root, Inc.**
Completion: Fall 1957.
Project: 556 miles of 30-in. from Mississippi Delta area south of New Orleans to Portland, Tenn.
Status: Pending FPC approval.
Project: 76 miles of 24-in. from Coudersport, Pa., to Hamburg, N. Y.
Status: Pending FPC approval.
Project: 163 miles of 30-in. and 101 miles of 26-in. from Portland, Tenn., to near Lancaster, Ky.; from Winchester, Ky., to Morehead, Ky.; from Catlettsburg, Ky., toward Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from Morehead, Ky., to Catlettsburg, Ky.
Status: Pending FPC approval.

• **Texas Gas Transmission Corp.**
Project: 20 miles of 18-in. near Bastrop, La.
Status: Work starts September 1, 1957.
Contractor: **Houston Contracting Co.,** W. H. Hayes, supt.

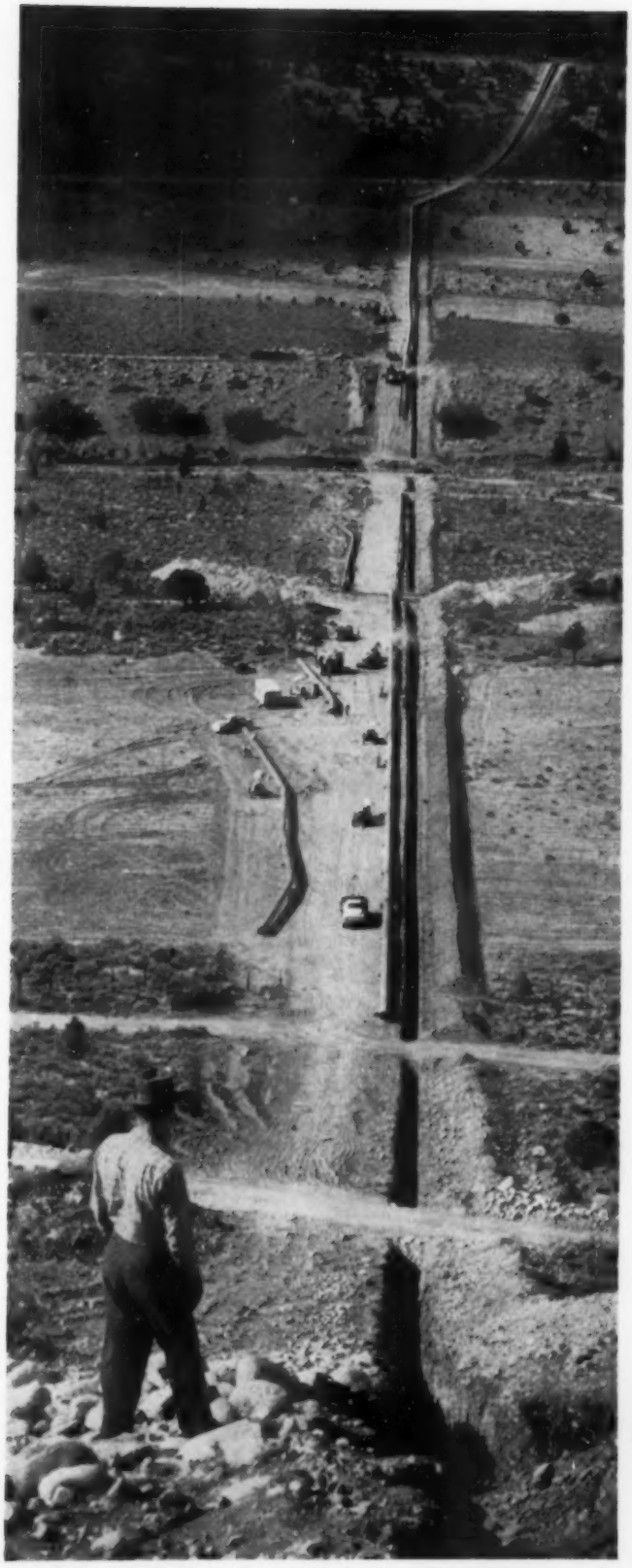
• **Texas Eastern Transmission Corp.**
Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.
Status: Has FPC approval.
Project: 140 miles of 30-in. between Kosciusko, Miss., and Uniontown, Pa., 105 miles of 30-in. between Opelousas, La., and Kosciusko, 22 miles of 14-in. supply line in La.
Status: Pending FPC approval.
Project: 667 miles of 30-in. from Kosciusko, Miss., to Uniontown, Pa.
Status: Under way.
Contractor: **H. C. Price Co.** (64 miles from Barton, Ala., to Mount Pleasant, Tenn.; 51 miles from Mount Pleasant to Gladeville, Tenn.; 52 miles from Gladeville to Tompkinsville, Ky.; 68 miles from Tompkinsville to Danville, Ky.; 63 miles from Danville to Owingsville; 46 miles from Owingsville to Wheelersburg, Ohio. Will use four spreads); **Williams Brothers Co.** (63 miles from Egypt, Miss., to Barton, Ala.; 64 miles from Berne, Ohio, to Uniontown, Pa.); **Houston Contracting Co.** (80 miles from Kosciusko to Egypt, Miss., M. L. Thompson, supt., office at Kosciuski and Ackerman. 57 miles from Wheelersburg to Athens, Ohio, W. H. Hayes, supt., office at Oak Hill; 61 miles from Athens to Berne, Ohio, R. E. Thornton, supt., office at Chauncey).
Completion: Fall 1957.

• **Texas Illinois Natural Gas Pipeline Co.**
Project: 44 miles of 36-in. and 4 miles of 34-in. from south of Joliet, Ill., to Howard Street, west of Chicago.
Status: To start September 20, 1957.
Contractor: **Midwestern Constructors, Inc.**
Completion: Depends on pipe delivery.

• **Transcontinental Gas Pipe Line Corp.**
Project: 172 miles of 36-in., 68 miles of 30-in., 162 miles of 24-in., and 64 miles of smaller size loops from Tex. to N. J.
Status: Work in North Carolina under way.
Contractor: **Western Construction Co.** has 65 miles of 36-in. and 45 miles of 30-in. at scattered spots along system in S. C., N. C., Pa., and Va. Work will start in N. C., office at Winston-Salem.
Completion: December 1957.
Project: 110 miles of 36-in., 16 miles of 30-in., and 13 miles of 24-in. looping in S. Car., Ga., Ala., Miss., and La.
Status: Under way.
Contractor: **Sharman, Allen, Gay & Taylor, Inc.,** E. D. Singleton, superintendent.
Completion: November 1957.
Project: 57 miles of 30, 36-in. loops in La., Miss., Ala., Ga., S. C., and 247 miles of mostly 24 and 16-in. laterals in Tex. and La.
Status: Under way.
Completion: December 1957.

• **Trans-Western Pipe Line Co.** (Warren Petroleum, Monterey Oil Co., J. B. Butler.)
Project: A line from Four Corners area to Calif. border.
Status: Proposed.

• **United Gas Pipe Line Co.**
Project: 9 miles of 8, 10, 12-in. between



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Here's pipe that's made for rigorous conditions. *Precision* pipe that in every length assures the kind of true uniformity that makes handling easier, installation quicker.

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Result: in diameter, concentricity, ductility, strength . . . wherever accuracy and performance count most . . . you can count on pipe of Kaiser Steel to pay off for you in the field.

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Steel Mill Products: plates • hot rolled strip and sheet • cold rolled strip and sheet • tin plate • continuous weld pipe • electric weld pipe • alloy and carbon bars • bar shapes • structural shapes semi-finished steels • pig iron • ingot molds • coke by-products • **Fabricating Division:** steel fabrication for construction, aircraft, missile and other industries • expanded fusion weld pipe reinforced concrete pipe • tanks • For specifications, write: **KAISER STEEL CORPORATION** • **Los Angeles** • **Oakland** • **Seattle** • **Portland** • **Phoenix** • **Denver** • **Tulsa** • **New York**

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MORE RUGGED
"PUSH BUTTON"
LOCKING DEVICE

Featuring exclusive advances in an outstanding design—Williams new improved, patented Locking Adjustable is built to resist the abuse of heavy service commonly associated with this type of wrench. Diagrams point up major improvements in locking mechanism.

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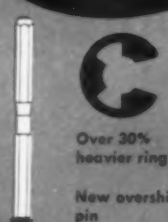
Your local Williams distributor will give you fastest service at lowest cost.

For detailed data on the "Broadest Line of its Kind" . . . WRITE for Catalog 303.

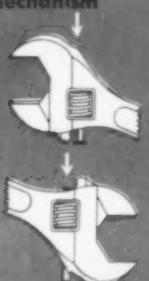
DUE TO WILLIAMS CONTINUOUS PRODUCT DEVELOPMENT PROGRAM THESE 4 IMPROVEMENTS HAVE BEEN MADE



2-way protection of locking mechanism

If head of pin is struck directly, pin goes into overshift position.

Upon impact at head of wrench, inertia is stopped by shoulder on bottom of pin.



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Pipeline Patrol

Grand Cheinier, La., and Forest Oil Co.'s Block 4 in Gulf of Mexico.
Status: Under way.
Contractor: **Sam Carline, Inc.**
Completion: September 15, 1957.
Project: 18 miles of 12-in. from Lirette-Mobile line in Jackson County, south to Bayou Casottee industrial area east of Pascagoula, Miss.
Status: Filed for FPC permit.

- **Western Slope Gas Co.**

Project: 36 miles of 4-in. from Piceance Creek field in northwestern Colo., to Rifle, Colo.
Status: Under way.
Completion: October 1957.

Canadian Crude-Oil Pipelines

- **Act Oils, Ltd.**

Project: A 450-mile line from the Peace River region of northern B. C. to tidewater at Bella Coola, B. C.
Status: Request has been made for permit from the B. C. government.

- **B-A Alberta Pipe Line, Ltd.**

Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

- **Pembina Pipe Line, Ltd.**

Project: 100 miles of 3 to 12-in. gathering line in Pembina oil field, Alta.
Contractor: **Universal Pipe Line, Ltd.**, subsidiary of Mannix, Ltd., T. Childress, spread superintendent, office at Drayton Valley, Alta.
Completion: November 1, 1957.

- **Royalite Oil Co., Ltd.**

Project: 250-mile line from Athabasca oil sands, northeastern Alta., to Edmonton.
Status: Long range plans.
Completion: 1960.

- **Westspur Pipe Line Co.**

Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields: 14 miles of 4, 6, 8-in. gathering lines.
Completion: River crossing completed. Total project to be completed in 1960.
Status: Has requested permit from Board of Transport Commissioners.
Contractor: **Majestic Contractors, Ltd.**, Jeff Minter, supt., office at Estevan, Sask.
Completion: No date set.

Canadian Products Pipelines

- **Hydrocarbons Pipeline Co.**

Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.
Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start in 1957.
Construction consultants: **Dutton-Williams Brothers, Ltd.**, and **A. D. Little Co.**

Canadian Natural-Gas Pipelines

- **Alberta Gas Trunk Line Co., Ltd.**

Project: 637 miles of 34 to 16-in. gathering lines in Alberta.
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd.** has preliminary studies, design and management-engineering. **Universal Pipe Line, Ltd.** subsidiary of Mannix, Ltd., jointly with **Marine Pipeline & Dredging Co.**, has crossing of Red Deer River near Cavendish, Alta., J. Hysuick, spread superintendent, office at Empress. **Fulton Banister, Ltd.**, has completed 17 miles of 34-in. west from Burstall, Sask., to near Cavendish, Alta., and has under way 100 miles of 18-in. north to Bindloss and Provost fields, George Caron, supt., office at Oyen, Alta., to complete summer 1957.

Pipeline Patrol

• **Inland Natural Gas Co., Ltd.**
Project: 304 miles of mainline and 2: miles of laterals from Savona to Nelson B. C.: 150 miles of 12-in.; 112 miles of 10-in. 57 miles of 6-in. Also will build 400 mile of distribution piping in 31 towns.
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd** Pat Campbell, manager, office at Perticton.
Completion: October 1, 1957.

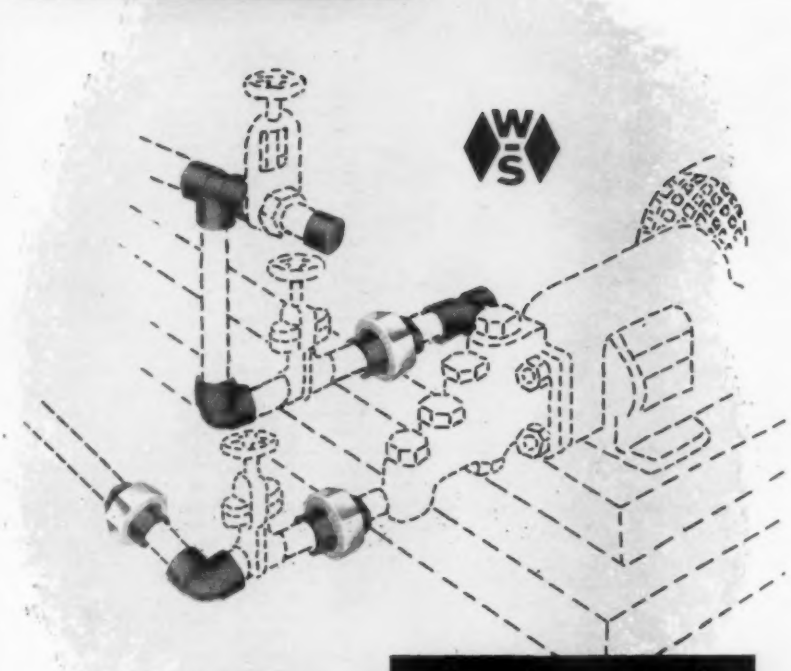
• **North Canadian Oils, Ltd.**
Project: 47-mile extension into Jasper, Alta., of its 10-in. line from Wabamun to Hinton west of Edmonton.

• **Northern Ontario Pipe Line Crown Corp.**
Project: 675 miles of 30-in. from the Ontario-Manitoba border to near Kapuskasing, Ont. (part of the 2,250-mile Trans-Canada line; will be leased to Trans-Canada Pipe Line Co. with option to buy.)
Status: 79-mile section from Stedman to Forham Township under way.
Contractor: **Dutton Williams Brothers** has 58 miles from the Manitoba-Ontario border west of Kenora to a point east of the crossing of Ontario Highway 17. **Morrison Shivers, Ltd.** has 94 miles from the east crossing of Highway 17 to a line separating the townships of Hyndman and Hodgson. **Majestic Contractors & Associates** has 80 miles from the Morrison Shivers terminal to Stedman Township. **Houston Contracting Co.** has 79 miles from Stedman to Forham Township. R. L. Silar, spread superintendent, office at Raith, Ont.
Contractor: **River Construction Corp.**, has Winnipeg River crossing near Kenora, Ont to complete November 15, 1957.
Completion: End 1957.

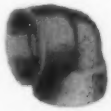
• **Provo Gas Producers, Ltd.**
Project: 22 miles of 3 to 12-in. gathering lines and wellhead tie-ins in Provost Field Alta.
Status: Under way.
Contractor: **Fulton Banister, Ltd.**, Jim Boyce, supt., office at Consort.

• **Trans-Canada Pipe Lines, Ltd.**
Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg, 310 miles of 20-in. from Toronto to Montreal, 33 miles of 24-in. from Toronto to Niagara, N. Y.
Status: Under way.
Contractor: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leonard, supt., office at Cabri); **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., completed, and 87 miles from Portage la Prairie to Winnipeg, Man., to complete August 20, 1957, J. L. (Joe) Work, supt., offices at Portage la Prairie and Winnipeg); **Universal Pipe Line, Ltd.**, subsidiary of Mannix, Ltd. (90 miles from Moose Jaw to Welseley, Sask., supt., Otis Hare, office at Regina, Sask.); **Dutton-Williams Brothers, Ltd.** (97 miles from Deveren to Moosomin, Sask., to complete August 1957, plus 120 miles of 20-in. between Toronto and Montreal); **Price-Poole of Canada, Ltd.** (100 miles from near McGregor to Miniota, Man.); **Oklahoma Pipe Line Constructors** (83 miles of 20, 24-in. between Toronto and Montreal, and between Toronto and Niagara, N. Y.); **Grayco Constructors, Inc.** (120 miles of 20-in. between Toronto and Montreal).
Completion: 1957.
Project: 82 miles of 30-in. from near Winnipeg to the Ontario-Manitoba border.
Status: Under way.
Contractor: **Majestic Contractors, Ltd.**, K. B. Killingsworth, spread superintendent. office at Ste. Anne, Man.
Completion: October 15, 1957.

W-S Forged Steel Fittings...



Standouts for Pump and Compressor Piping



Whether the fluid be water, steam, oil, gas or chemical solutions . . . if they are being pumped at high pressure, W-S Forged Steel Fittings will protect your pump or compressor piping. They are designed and manufactured to provide maximum resistance to pressure, shock and vibration.

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W-S FITTINGS DIVISION

Pipeline Patrol

• **Union Gas Co. of Canada, Ltd.**
Project: 142 miles of 26-in. from Dawn Township to Hamilton, Ontario, plus 55 miles of 6 to 20-in. laterals, and 317 miles of 2 to 12-in. distribution lines.
Status: Under way.
Contractor: **Canadian Bechtel, Ltd.** has the 26-in. line, to complete November 15, 1957, office at Galt, Ont.
Completion: November 30, 1957.

• **Westcoast Transmission Co., Ltd.**
Project: 42 miles of 20-in. and 100 miles of 30 in. from Savanna Creek area, Alta., to Canadian-Idaho border.
Status: Planned.
Completion: November 1, 1958.

Foreign Crude-Oil Pipelines

• **Bolivian Gulf Oil Corp.**
Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicasicia to Arica on the Chilean coast.
Status: To start late 1957.
Contractor: **Williams Brothers Co.**
Completion: 1958.

• **Bolivia-Paraguay**
Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned.
Contractor: Five Lilles, a French Combine.

• **Burmah Oil Co., Ltd.**
Project: 850 miles of 20-in. from Nahorkatiya to Calcutta, India.
Status: Under way.
Contractor: **Collins Construction Co.** is surveying locations for some 40 river crossings.

• **Caltex**
Project: 30 miles of 30-in. from Duri field in Sumatra to Dumai where a deepwater terminal will be built. Line will be extended 35 miles to Minas field later.
Status: Planned.
Completion: Duri-Dumai line to be finished in 1959; extension to Minas later.

• **Colombian Petroleum Co.**
Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.
Status: Under way.

• **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), and Cie. Francaise des Petroles Algerie**
Project: Two 10-in. lines from Hassi Messaoud and Edjele, Algeria to the railhead at Touggourt.
Status: Planned.
Completion: 1958.
Project: 450 miles of 16-in. from Edjele field in southeastern Algeria to a Mediterranean port on the Libyan coast.
Status: Pipe has been ordered.

• **Creole Petroleum Corp.**
Project: 87 miles of 30-in. from Temblador field to Caripito in Venezuela.
Status: To start work early 1958.
Contractor: **Pipe Line Engineering Co.** and **Oklahoma Pipe Line Constructors.**
Completion: April 1958.
Project: 9 miles of 26-in. from Ule to La Salina in Venezuela.
Status: Planned.
Completion: Late 1957.

• **Deutsche-Shell A.G.**
Project: 120 miles of 20, 24-in. from Marseilles, France, to Rotterdam, Germany, to tap the 700 mile trans-Europe line proposed by the Royal Dutch-Shell Group.
Status: Planned.
Completion: 1960.

• **Iraq Petroleum Co.**
Project: About 600 miles of up to 40-in from Kirkuk field through Iraq to Turkish port of Iskenderun on the Mediterranean.
Status: Proposed. Survey completed.

• **Mene Grande Oil Co.**
Project: 97 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.
Status: Under way.
Contractor: **Fulghum Contracting Corp.** has 22 miles between Oficina and Anaco.
Completion: First quarter 1958.
Project: 45 miles of 24-in. from Oficina to Melones, Venezuela.
Status: Planned.
Completion: First quarter 1958.

• **Middle East Pipeline**
Project: 1,500 miles of 38 and 40-in. line from Persian Gulf to Mediterranean at Iskenderun, Turkey.
Status: Proposed.

• **National Iranian Oil Co.**
Project: A 1,000-mile line to move Qum crude to the Mediterranean.
Status: Under study.

• **North-West Oil Pipelines Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)
Project: 210-mile line from the refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven
Status: Planned.
Completion: 1959.

• **Royal Dutch-Shell**
Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.
Status: Company is considering project together with several other companies.

• **Standard-Vacuum Petroleum Maatschappij.**
Project: 94 miles of 8-in. from Lirik field, Central Sumatra, to deep-water terminal on Siak River, near Buatan. A 3-in. hot-water "defroster" line will be laid under the 8-in. to heat the heavy crude.
Status: Under way.
Completion: Late 1957.

• **Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie**
Project: Line in Sahara Desert area to move oil from Hassi Massaoud field. Two routes possible: 200 miles from the field northwest to Laghouat; 260 miles from the field to the north and slightly east to Biskra.
Status: Under study.

• **Union of Soviet Socialist Republic**
Project: 2,300-mile Trans-Siberian crude-products line from Ufa Tuimaza fields in Bashkiria to Irkutsk near Lake Balkal.

• **Yacimientos Petroliferos Fiscales** (Argentina)
Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Planned.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.).
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

Foreign Products Pipelines

• **Empresa Nacional de Petroleos** (Government of Chile) and **Cia. de Petroleos de Chile (Copec), et al.**
Project: 75 miles of 10-in. from Chile's coastal refinery at Concon to Santiago.
Status: To start work September 1957.
Contractor: **Williams Brothers**
Completion: Early 1958.

• **Israeli Government**
Project: A 6-in. line from the Haifa refinery to Tel Aviv.
Completion: Late 1957.

• **Mene Grande Oil Co.**
Project: 60 miles of 6-in. L.P.G. line from Anaco to Puerto La Cruz, Venezuela.
Status: Planned.
Completion: Fourth quarter 1957.

• **North Atlantic Treaty Organization**
Project: 2,000 miles of lines to airfields in parts of Europe.
Status: Under way.
Contractor: **Associated Pipeline Contractors, Inc.** (450 miles from Iskenderun, Turkey to Batman); **TECHINT** (205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir).

Foreign Natural-Gas Pipelines

• **Attock Oil Co.**
Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.
Status: Planned.

• **Gaz de France**
Project: 550 miles of 16 to 24-in. from Lacq field, southwestern France, to Paris, plus a 10-in. lateral to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.
Status: Under way.
Contractor: French contractors.
Completion: First stage in 1958; complete system in 1960.

• **Edwin W. Pauley**
Project: 650-mile pipeline from Campeche area of Mexico across Yucatan and on the ocean floor to Havana, Cuba; 150 miles would be submarine.
Status: Being studied by Ebasco Services.

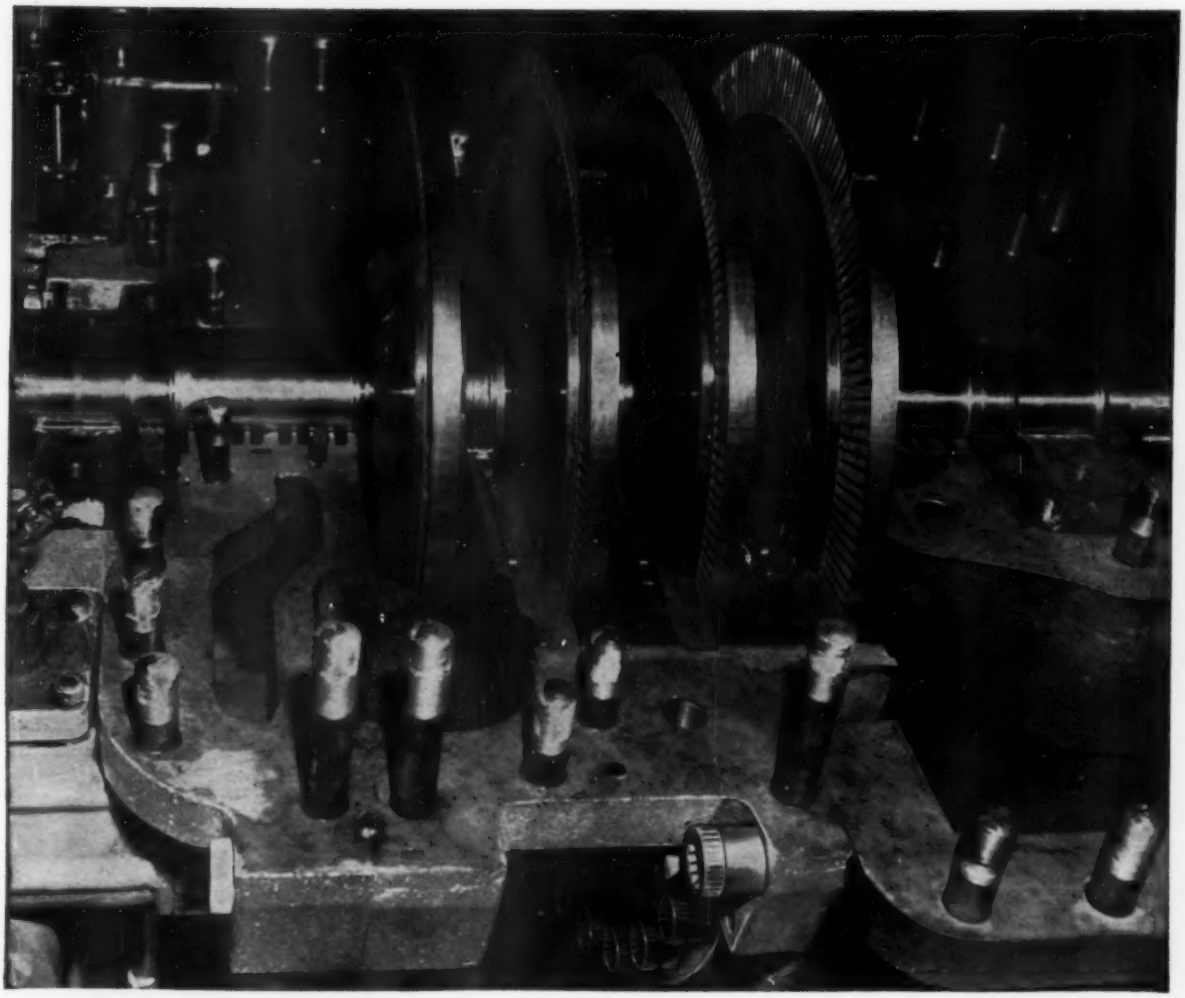
• **Petroleos Mexicanos**
Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey.

• **Sui Gas Transmission Co.**
Project: 217 miles of 16-in. from Sui gas field to Moultan, Pakistan.
Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang Magiana, and Montgomery.
Contractors: **Pakistan Constructors**, a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.**, of London.
Project: 145-mile line from Sylhet to Dacca, East Pakistan.
Status: Under consideration. If approved construction could start December 1958.

• **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.**
Project: 207 miles of 26-in. from Anaco fields to Caracas.
Status: Under way.
Contractor: **Fulghum Contracting Corp.** will be consultants; **Petrogas, S. A.** will engineer and construct the line.
Completion: Spring 1959.

• **Union of Soviet Socialist Republic.**
Project: 808 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow, to serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

• **Yacimientos Petroliferos Fiscales (Argentina)**
Project: 1,015 miles of 24-in. from Camp Duran to Buenos Aires.
Status: Planned.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.).



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A look at the heavy flanges and husky bolting in the actual unretouched shop photo shown above bears out the extreme ruggedness that typifies every feature of Murray construction.

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Among the Drilling Contractors

Rimrock Lets Contract For First Drilling Barge

Rimrock Tidelands, Inc., New Orleans, has let contract for the building of a submersible drilling barge for use in offshore operations along the Louisiana-Texas Gulf Coast.

It will be the company's first drilling barge. Four other Rimrock rigs engaged in offshore operations are on stationary platforms for Sinclair Oil & Gas Co. Another will go on an offshore barge being built for Union Producing Co. under an 8-year drilling contract.

The new barge, to be built by Southern Shipbuilding Corp., Slidell, La., is scheduled to be launched next March. It will be available either for Rimrock's own offshore exploration program, or for contract drilling.

Design is of the John Hayward type for drilling in water depths of from 12 to 35 ft. Its drilling equipment will be capable of going to 20,000 ft. The nucleus of this will be an Emsco A-1500 draw works, powered by a General Motors 6-110 quad and a 6-110 twin engine, totaling 1,500 hp., and two 1,000-hp. Gardner-Denver pumps, powered by two compounded G. M. 6-110 quads. It will use an Emsco 142-ft., 1,000,000-lb. load capacity mast.

Holm Drilling Co., Tulsa, has a new wildcat operation in Kansas' far-west Stanton County. It is for William Gruenerald at 1 Tucker, in 29-30s-41w. This is about 8 miles southeast of Mantor, and about 3½ miles east of Sparks pool. A 5,400-ft. test is planned.

B & B Drilling Co. has contracts for two Paleozoic tests in Greene County, on Alabama's upper west side. They will be for L. M. Glasco, of Dallas. Locations of the tests, in adjoining sections (18 and 19-23n-1w), are about a mile apart in an area about 10 miles northwest of Clinton, in the northwestern part of the county. Both are relatively shallow with objective depths about 1,900 ft.

Sharp Gulf Drilling Co., Houston, has a new contract job in the Lake Hatch area, 15 miles southwest of Houma, in Terrebonne Parish, southeastern Louisiana. It is a 10,000-ft. test for Argo Oil Corp. and Superior Oil Co. at 2 Southdown, in 10-18s-16e. Gracey-Hellums Corp., Houston, also is keeping a rig working in this area. It currently is on a Union Oil-Austral-Superior job (1 L.L.&E. Unit 3), same section.

Globe Drilling Co., Tyler, Tex., has a new wildcat location waiting south of Keechi, in northern Leon County, East Texas, when its rig is released from another test it is drilling in the

EVENING TOUR crew on Parker Drilling Co.'s rig (No. 26) which has been putting down Texas' deepest hole, 13 miles southeast of Fort Stockton, in far-western Pecos County. The rig, working under contract for Pan American Petroleum Corp. and Gulf Oil Corp., is drilling ahead below 19,100 ft. after having passed the state's previous drilled depth record of 19,060 ft.

In the picture, left to right at rear of rig, are: Timothy Keleher, D. D. Spivey, and Raymond Strong, floormen; Ralph Abney, motorman; Marvin Monshousen, derrickman; and Ray Cearlock, driller. Operators plan to take the test, 1-CS University, another 500 to 1,000 ft. deeper.

for successful fracturing
of your well...

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VIS-O-FRAC

Base Fluid	Crude oil or light refined oils
Gelling Agent	Soap formed in situ
Method of Field Mixing	Batch or continuous
Type of Finished Fluid	Non-Newtonian gel • not an emulsion
Method of Viscosity Reduction	Easily diluted to low viscosity by formation oil
Fluid Loss Properties—API Code 29	Will vary with base fluid but normally will be 10-45 cc. Can usually be lowered with low fluid loss additives to 5-15 cc.
Temperature Stability of Fluid	Slight decrease in viscosity with increase in temperature. Viscosity index much higher than the base oil.
Sand Transporting Characteristics	Good • falling rate very slow. Normally, 1-3 lbs. per gallon is used.
Types of Formations Best Suited	Oil and gas bearing formations.

To stimulate production in your reservoir, Halliburton's VIS-O-FRAC offers you these benefits:

LOW FRICTION LOSS • GOOD SAND TRANSPORTABILITY • ECONOMY

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15. Pampa, Texas
16. Lubbock, Texas
17. Snyder, Texas
18. Abilene, Texas
19. Electra, Texas
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Armco Casing offers many advantages to drillers. Long, 40-foot lengths mean fewer joints to handle and weld. The Armco Slip-Joint allows quick stabbing and fast, easy lineup. Diameters range from 6 to 24 inches, wall thicknesses from $\frac{3}{16}$- to $\frac{1}{2}$-inch.

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same area. Current operation is a 7,000-ft. test for Roger Stewart and associates at 1 Keils, in the John S. Carson Survey. The new location, about ½ mile north, in the same survey, will be drilled for Sid Katz Oil Co. Its permit calls for a 6,500-ft. test.

Hulme Drilling Co. is on a new contract job in Meade County, southwestern Kansas. It is a 6,150-ft. Morrow test for Skelly Oil Co. at 1 Mohler, in 35-33-29. Location is 11 miles southeast of Plains, Kans., and about 2 miles east of Singley field, nearest production.

Dutton Drilling Co. is getting under way on a deep test for Cooper Petroleum Co. at a wildcat location 4 miles north of Sour Lake, in Hardin County, Texas Gulf Coast. Location is for 1 Ella Lewis Estate Unit 1, in the BBB&C Survey. It is off the north side of Sour Lake production. Contract is for 10,500 ft.

Carl Short, Dallas, is to drill a new wildcat location Pure Oil Co. has made southwest of the old Gueydan field, in northwestern Vermilion Parish, Louisiana Gulf Coast. This will be a 12,000-ft. test on Pure's Southwest Louisiana Land Co. lease. Location, in 4-12s-1w, is a mile from production.

Clegg & Hunt, Houston, has contracted for a 10,750-ft. test off the north flank of North Welsh field, in Jefferson Davis Parish, South Louisiana. Operator is Manco Corp., of Corpus Christi, Tex. The new operation, at 1 Monks, in 3-9s-5w, is about 3½ miles northeast of Woodlawn field.

Sierra Drilling Co. has a new wildcat operation in Bastrop County, South Texas. It is a contract job for Morris Cannan at 1 Dinges, in the Tim McKean Survey. Location is about 3 miles southeast of Red Rock. A 4,800-ft. test is planned.

Helmerich & Payne, Inc., Tulsa, is drilling for Shell Oil Co. at a newly started wildcat in Cimarron County, Oklahoma Panhandle. Location is about 18 miles northwest of Boise City in the western part of the county. Spot is in 23-4n-2eCM, on a state lease.

C. G. Glasscock Drilling Co., Corpus Christi, has taken an ultradeep offshore drilling job for Continental Oil Co., operating for the C.A.T.C. group. It is at a wildcat location in Block 48, Grand Isle area, Gulf of Mexico. Location is about 18 miles off Jefferson Parish, Louisiana, and about 2 miles west of Block 47 field. Operators have a permit to go to 16,000 ft.

Kraftbilt

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DESIGNED BY KRAFTBILT EXPERTS AFTER CONSULTING NUMEROUS OIL MEN

Quicker and more efficiently — that's how your production reporting goes when you use Kraftbilt's special forms. This complete line includes gauge tickets, well test forms, production summary and audit forms, and pipe line run tickets. Available NOW!

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Specialists to the Petro-Chemical Engineering Field . . . based on scope, quality and service. Equipment available from stock, or made to your exact requirements.

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FOR COMPLETE PRODUCTION HARMONY

Go CONTINENTAL-EMSCO

Lift page for subsurface equipment

Your D+B man has the answer to your bottom hole pump problems

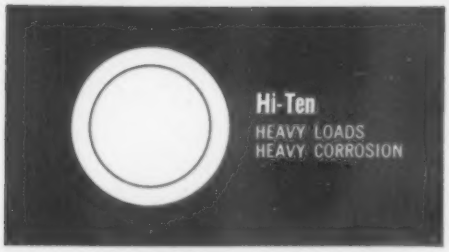
Whatever the well condition, your Continental-Emsco D+B specialist has a pump for lower lifting cost. In problem wells, he can analyze well conditions and suggest materials, parts and pump design to reduce costly pulling jobs. His recommendations are based on day-by-day experience, a working knowledge of the field he serves, and complete service records of D+B pumps operating in the area. He will pick up your pumps in the field and see that they are properly repaired in our fully equipped pump shops . . manned by company trained repairmen.

For high quality pumps and replacement parts . . at competitive prices . . see your D+B man and be assured of steady, sure production.

HEAVY DU

for Service

ask a D+B man ...



Stopping rod failures before they start is the business of your D+B man

When planning to place a well on the pump, your Continental-Emsco D+B representative is the man to see. He can recommend the grade of sucker rod for every well condition . . often solving many problems at lower cost to you.

Car load or single string orders are quickly dispatched from ample store and warehouse stocks located throughout producing areas. This assures a dependable supply of rods close to your wells. Continental-Emsco field engineers stand ready to see that the right sucker rod string is installed for trouble-free pumping.

Type 5

Y DUTY • MEDIUM CORROSION

that Sings..

Just ASK a D+B man

Steady, sure pumping power with

C-E PUMPING ENGINES

Here are *completely* weatherproof engines. They are doing a real pumping job in hot and cold, wet and dry climates throughout the world. They are easy to start . . simple to operate.

Major items such as wet-type cylinder sleeves, valves, valve guides and inserts can be renewed in the field for many additional years of pumping. Disassembly is not necessary to adjust or install many small parts . . maintenance downtime is greatly reduced.

. . Equipmen

You're Money Ahead with C-E

Steady, sure,
low-cost production
with

CONTINENTAL-EMSCO UNIT PUMPERS

The wide size range of Continental-Emsco API Unit Pumpers makes it possible to apply a unit that will handle your individual well requirements at the lowest possible cost. Low cost, because you're assured of correct recommendations and installation. Low cost, because C-E Unit Pumpers are *Engineered*. . not just built.

C-E Unit Pumpers are equipped with patented counterbalances. This makes it possible for one man to counterbalance a well safely. . at ground level.

Engineered . .
Not Just Built

Don't forget

GREEN TRIANGLE V-BELTS

. . in matched sets

Why V-belts in matched sets? Because with matched sets you get *uniformity* of size . material . . freshness . . tension . . for a dependable power hook-up.

GREEN TRIANGLE V-belts . . made by the New York Belting and Packing Company . . are especially matched in sets . . and especially designed to meet the gritty, oily, day-in and day-out conditions of oil field pumping.

Don't neglect this *vital link*. Insist upon GREEN TRIANGLE V-belts for steady, sure pumping. Always available through your nearby Continental-Emsco stores.

t that Hums

E on Both Installation and Operation

"Walt, here's my problem . . "

This field superintendent had a problem . . maybe large . . maybe small. But you can be sure he found a solution at his Continental-Emsco store. These *complete supply stores* are fully stocked and manned by capable personnel . . ever concerned with your problems.

Continental-Emsco stores have the supplies, tools and equipment to do your job better. Drop in anytime . . see what we have in stock . . see what's new. Make it a habit to buy . . *in person* . . at your Continental-Emsco store.

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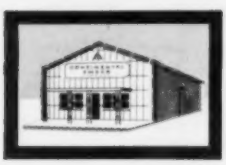

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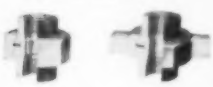
For the Oil and Gas Industries

by the makers of

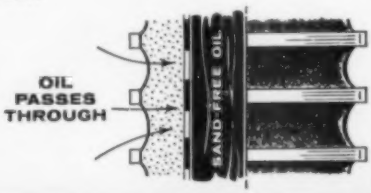


Petro and Handle-Bar Unions

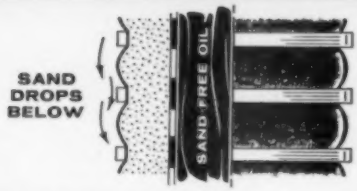
NEW

INHALES OIL on the up-stroke

Filtering element of special, flexible synthetic foam rubber allows fluid to pass through its microscopic pores. Sand is stopped on the outside during the up-stroke.



It Breathes!



REJECTS SAND on the down-stroke

On the down-stroke the flexible filtering element relaxes. Sand stopped on the outside of the rubber filtering element during the intake of oil is rejected. This "breathing" action prevents formation of sand cake on filter.

Clayton Mark Filter

Delivers Sand-Free Oil

Sand-Free Filter Eliminates

Sand-Stuck Pumps..

Sand Cutting and Scoring

The only one of its kind..

PROVEN IN ACTUAL FIELD SERVICE

Years of testing have proven that the Mark Sand-Free Filter keeps sand out of the pump.. but will not restrict intake of oil. This new filter has successfully eliminated production problems due to all types of formation sand.. and those due to sand-frac materials.

Recently given a full scale test in the Mid-Continent and Rocky Mountain oil fields, the filter showed phenomenal success. Typical of the results was one well that had required 5 service operations during a month's run. On last report this same well, after installation of a Mark Sand-Free Filter, had 78 days of continuous operation with no down time.

Don't let sand cut your production dollars.. get the complete Mark Sand-Free Filter story and test reports from your local Continental-Emsco representative today. Available in 2⅜" O.D., 8 Rd. EUE now.

MANUFACTURED BY CLAYTON MARK & CO., EVANSTON, ILL., U.S.A.

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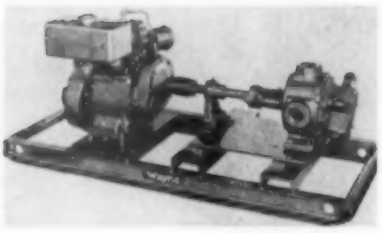
SHOWCASE...

NEW EQUIPMENT

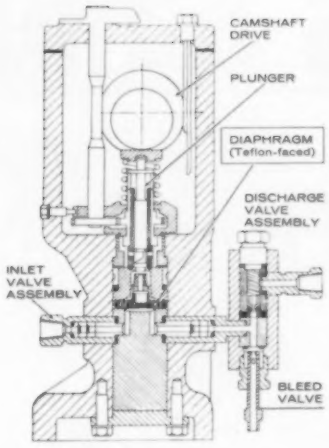


Engine-Driven Pump For Oil Transfer

From 18 to 100 bbl. per minute of oil or other liquids can be transferred with this new series of Wayne engine-driven-pump unit, consisting of five basic assemblies, the maker reports.

The assemblies may also be operated at full ratings for solvents and other organic liquids, many acids and bases, water and other liquids in wide viscosity ranges, according to the company. Called the GED Series, the pumps may be had in all-iron, all-bronze, or bronze-fitted construction. This depends on the liquid pumped.

All models are designed for operation at 100 psi. The horsepower ratings of the engines range from 5 to 8 hp. **Write or call: Wayne Pump Co., Fort Wayne, Ind., for details on GED Series pumps.**



Packless Pump Meters, Proportions Fluids

At pressures up to 2,500 psi., this new packless diaphragm pump for proportioning and meter fluids performs with exceptional accuracy, the maker says. Its diaphragm consists of solid Teflon permanently bonded to, and covering, the face of an elastomeric backing. This type of construction is said to assure long diaphragm life by combining the chemical resistance of Teflon with the flexibility of an elastomeric backing.

The pump is designed to give smooth, continuous flow in a wide output range. **Write or call: Hills-McCanna Co., West Nelson Street, Chicago 18, Ill., for details on packless diaphragm pump.**

●

Erasing Machine Quickly Removes Errors

Fast erasing with little fatigue is offered by this new Post electric erasing machine developed especially for the engineer and draftsman, the maker claims.

Called the Sovereign, the machine reportedly operates cool under heavy working conditions. It has minimum torque and automatic stall control to protect drawings against damage from heavy pressure. The machine is said to be lightweight and easy to handle. **Write or call: Frederick Post Co., 3650 North Avondale Avenue, Chicago 18, Ill., for details on Sovereign erasing machine.**

●

Rotary PD Pump Uses Rubber Rollers

Rubber rollers act as rolling vanes in this new Hypro positive-displacement pump. This design reduces the friction normally associated with rotary positive displacement pumps, the company claims.

The pump can be direct-coupled to a gear reducer attached to a motor or engine. Equipped with 2-in. ports, it delivers up to 95 g.p.m. at 700 r.p.m. And its output is not greatly reduced at higher pressures.

A spring-loaded pressure-relief end

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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Described in THE OIL AND GAS JOURNAL - Issue of September 2, 1957

NAME.....TITLE.....

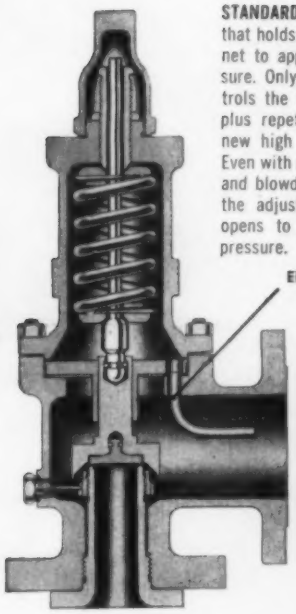
COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....

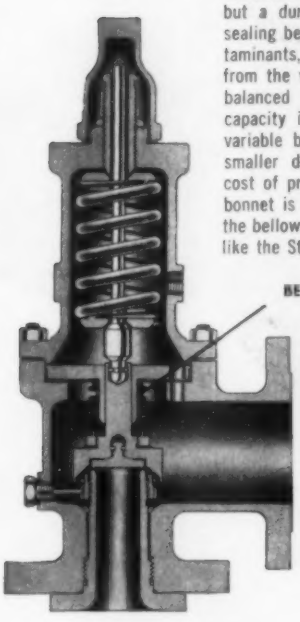
STANDARD VALVE. Note the eductor tube that holds the pressure in the valve bonnet to approximately atmospheric pressure. Only the force of the spring controls the valve. Far better valve action plus repetitive flow capacity assure a new high in operational dependability. Even with repeated popping, set pressure and blowdown are consistent. Whatever the adjusting ring position, the valve opens to full capacity at 10% over-pressure.



LOOK INSIDE

before you buy another safety relief valve

BELLOWS VALVE. Similar to the Standard, but a durable, two-ply stainless steel sealing bellows effectively isolates contaminants, corrosion or viscous fluids from the working parts. The bellows is balanced with the seating surface — capacity is less seriously affected by variable back pressure, so the use of smaller discharge piping reduces the cost of pressure-relieving systems. The bonnet is vented to the atmosphere. If the bellows ruptures, the valve operates like the Standard valve.



CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

LOOK INSIDE the Consolidated Safety Relief Valve. Fewer functional parts and precision machining and alignment of parts assure long valve life and less maintenance. Economical "2 in 1" design permits the Standard valve to be converted to the Bellows type right in your own shop.

There is only one adjusting ring—it can be set easily *before* valve installation to obtain peak performance at 4-5% blowdown. *Full-rated relieving capacity* is certain at all positions of the ring because a fixed maximum secondary orifice provides full lift at 10% over-pressure. *Valve action is consistently positive* even where "superimposed" back pressure is in the relieving system.

The temperature-compensating disc eliminates seat distortion caused by temperature-induced stresses — always seats tightly even when reasonable strains of unanchored discharge piping are present. A minimum guiding area is provided to align the seating surfaces — less chance of a sticking disc holder when corrosion or contamination build up on the guiding surfaces. The seating surfaces are optically-ground flat for easier, more economical servicing.

The contours of the huddling chamber and secondary orifice take full advantage of the stream pressure and kinetic forces. No other valve has this safety feature. Note the low placement of the threaded section that holds the nozzle in the valve. It assures high resistance to discharge piping strains — no leakage resulting from strain induced into the nozzle.

BE SURE OF ABSOLUTE PROTECTION for personnel and equipment — plus low maintenance. Select Consolidated Safety Relief Valves. Full range of sizes and pressures available with standardized inlet and outlet face-to-face dimensions for easy interchangeability with the valves of some other manufacturers. *Write for Catalog 1900.*

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.*

CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

HYDRAX
4-ft. JR.

Small economy size for low-production and stripper wells. Mounts directly on production tee with no need for foundation or substructures. Polished rod capacity: 8,000 lb.

HYDRAX
LONG STROKE
COUNTERBALANCE

With 28½-foot strokes, the most effective in the industry, lifts up to 32,000 lb., can produce more barrels of oil per day than ever before possible. Many units have paid for themselves in six months.

HYDRAX
6-ft. and 10-ft.

Slow upstroke and fast downstroke provide ideal pumping cycle for yielding maximum crude from medium-production wells as deep as 8,500 feet. Polished rod capacity: 13,000 lb.

HYDRAX 10-ft.
COUNTERBALANCE

Can produce oil from a depth of a mile and a half, lifting 18,000 lb. a distance of 10 feet as many as 8 times per minute. Counterbalance provided by air pressure reduces horsepower requirement.

FROM AXELSON...

the only complete line of hydraulic pumping units

THERE'S A HYDRAX FOR EVERY TYPE OF PRODUCTION, from shallow stripper wells to deep high-volume producers. Easy and inexpensive to install, HYDRAX units have smooth, hydraulically dampened strokes that pay off in reduced production costs:

- sucker rod life extended as much as eight times
- rod stresses safely increased as much as 30%
- greatly improved volumetric efficiency
- gas lock eliminated by high compression ratios
- less wear and tear on subsurface pumps
- less turbulence at well bottom

Every HYDRAX unit is backed by Axelson's 59 years experience in the design and manufacture of petroleum equipment (10 years in hydraulic pumpers) and by a nationwide service organization of factory-trained specialists who can be at any well site within hours.

For more information about HYDRAX, the complete family of hydraulic pumping units, call your Axelson representative or write for Bulletin PO9-H-153.

AXELSON

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AXELSON MANUFACTURING COMPANY
Division of U.S. Industries, Inc.
6160 South Boyle Avenue, Los Angeles 58, California

plate protects the pump and connecting pipe or hose from excessive pressure. The pump is reversible. It is self-priming up to 10 ft. above the liquid source. Once primed, it has a suction lift exceeding 20 ft.

With synthetic-rubber rollers, the pump is especially suitable for pumping water and many aqueous solutions. It is reasonably tolerant to nonabrasive solids entrained in the liquid. **Write or call: Hypro Engineering, Inc., 700 Thirty-ninth Avenue N. E., Minneapolis 21, Minn., for details on PD pump with rubber rollers.**

●

Bag Cutter May Save Time and Labor

Here's a new bag cutter for bagged refractories, cements, and chemicals. It cleanly cuts paper sacks in half for ease of lifting and empyting, the maker claims. To conserve labor, bags can be opened in advance of use with the device and stacked at the job site for rapid, convenient use.

The bag cutter can be used at floor level or raised to a desired height on its legs of 1-in. pipe. The blade is of hardened steel encased in a steel sheath when not in use. **Write or call: Ridley & Co., 11275 Massachusetts Avenue, Los Angeles 25, Calif., for details on bag cutter.**

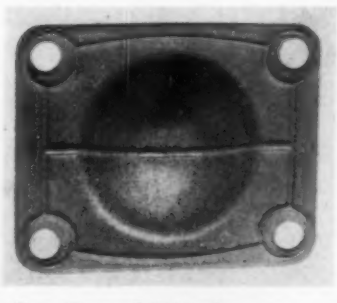
●

Aluminized Suit Protects Wearer at 2,000° F.

The aluminized suit shown here protects the wearer from burning gasoline or propane temperatures of more than 2,000° F., the maker reports. Yet it is lightweight and flexible enough to permit the wearer to work. The suit is made of an aluminized glass-fiber material. The thin coating of aluminum reflects 95 per cent of the radiant heat, according to the maker. Backing up the aluminum coating is a glass-fiber material and quilted glass-fiber insulation.

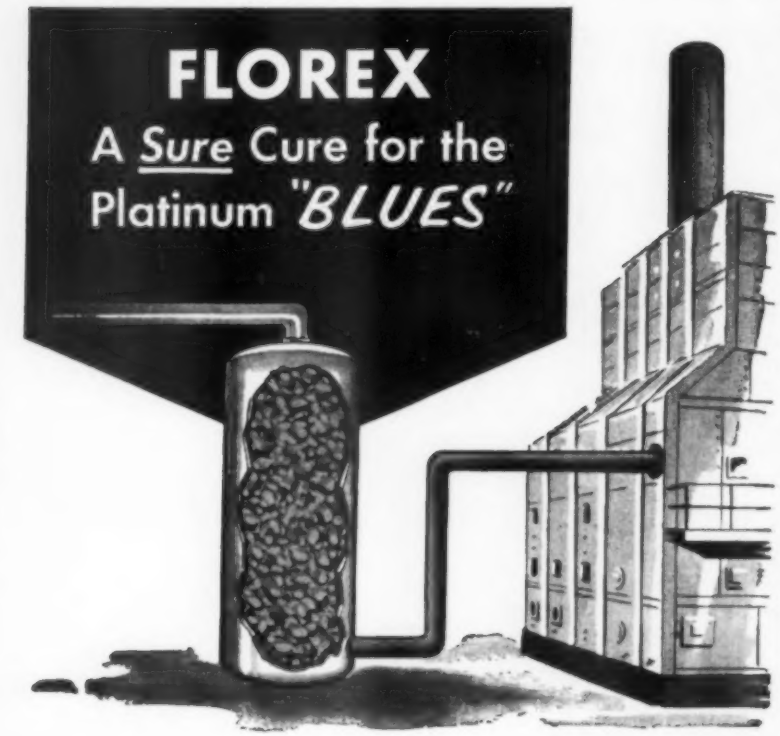
The suit consists of a three-quarter-length coat, chest-high pants, boots which reach halfway up the shin, and a helmet which overlaps the shoulders and chest. An air supply, worn under the arm and beneath the coat, is furnished the wearer through a mouth piece. **Write or call: Fyrepel Products, Inc., Newark, Ohio, for details on aluminized suit.**

●



Teflon-Faced Diaphragm Prevents Corrosion

Corrosion protection from both internal flow and the atmosphere is pro-



The growing use of platinum catalysts in reforming feed stock emphasizes the importance of pre-removing trace metals such as arsenic, lead and sulphur compounds. Platinum catalysts are poisoned by these substances in quantities even as small as ten parts per billion.

Treating the feed stock before the trouble occurs, Florex adsorbent provides the simplest, most economical means to protect expensive catalysts. Florex in the granular grades will completely remove or reduce these compounds to a harmless level.

Recognized throughout the world as superior to all other natural clays, Florex is prepared from carefully selected Florida Fuller's Earth by a special processing, including high pressure extrusion.

Meshes from 8/16 and up are customarily used. Write for information today.

FLORIDIN COMPANY Adsorbents Desiccants Diluents

Dept. C P. O. Box 989 Tallahassee, Fla.

vided by this new Teflon-faced diaphragm of one-piece construction for use in Hills-McCanna diaphragm valves. It's made with a solid Teflon sheeting, permanently bonded to the face and external edges of an elastomeric backing. This construction combines the chemical resistance of the solid Teflon diaphragm and the hydraulic shock-absorbing flexibility of elastomeric type of diaphragm, the maker says.

Sealing-bead construction gives positive closure, according to the company, under pressure or vacuum at operating temperatures ranging from —10° to 240° F. and line pressures up to 150 psi. **Write or call: Hills-McCanna Co., 2442 West Nelson Street, Chicago, Ill., for Bulletin 103.**

●

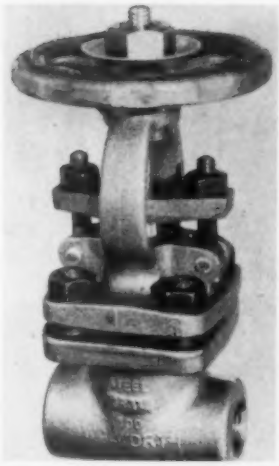
Self-Balancing Indicator Has Built-In Switches

Here's a new self-balancing indicator with built-in key or push-button switches. It is available for: (1) thermocouples with a null-balance potentiometer measuring circuit and automatic cold-junction compensation, or (2) resistance bulbs with a null-balance a.c. bridge-measuring circuit.

This indicator provides a convenient and accurate means of checking many temperatures from remote or nearby points, the maker says. A choice is offered of either two or three-position key or push-button switches.

The key switches accommodate up to 48 points for thermocouples and 36 points for resistance bulbs. The push-buttons accommodate up to 24 points for either one.

Thirty scale ranges are available covering —400° to +3,000° F. for all standard thermocouple calibrations and —100° to +600° F. for resistance bulbs. **Write or call: Thermo Electric Co., Saddle Brook, N. J., for details on self-balancing indicator.**



Steel-Wedge Gate Valve Handles Oil at 1,000° F.

Here's a new A.S.A. 600-lb. steel-wedge gate valve for water, steam, gas, or air service at temperatures up to 850° F. and for oil or oil-vapor service up to 1,000° F. Equipped with a body of forged carbon steel, the valve has a nonshock pressure-temperature rating of 420 psi. at 1,000° F. and a rating of 2,000 psi. at 100° F.

The stem, wedge, and seat rings are made of 13 per cent chromium stainless steel. The wedge, having a hardness of 500 Brinell, is accurately guided by ribs in the body.

The valve has outside screw and yoke design for repacking under pressure when fully opened. Curved yoke arms and swing type of eyebolts provide free access to the stuffing box.

The valve is available with screwed or socket-welding ends. With a union bonnet, it's available in eight sizes from ¼ to 2 in. With a bolted bonnet, it's available in six sizes from ½ to 2 in. **Write or call: Walworth Co., 60 East Forty-second Street, New York, N. Y., for details on 600 lb. steel gate valve for high temperatures.**

●

Graphite Burst Disk Accurate To 5 Per Cent of Rating

An accuracy of ± 5 per cent of rated burst pressure is provided by this new graphite burst disk for process pressure vessels, the maker claims.

Mounted in a special carbon holder, the disk is easily replaced. Sizes available range from 2 to 6 in. with ratings from 5 to 75 psig.

Operating pressures can be maintained indefinitely up to 74 per cent of rated pressure, the maker says. The unit is available with a graphite support bar for vacuum applications. **Write or call: Delanium Graphite Co., Elizabeth, N. J., for details on graphite burst disks.**

Send this **Showcase Coupon**

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in OIL AND GAS JOURNAL - Issue of September 2, 1957

NAME.....TITLE.....

COMPANY.....

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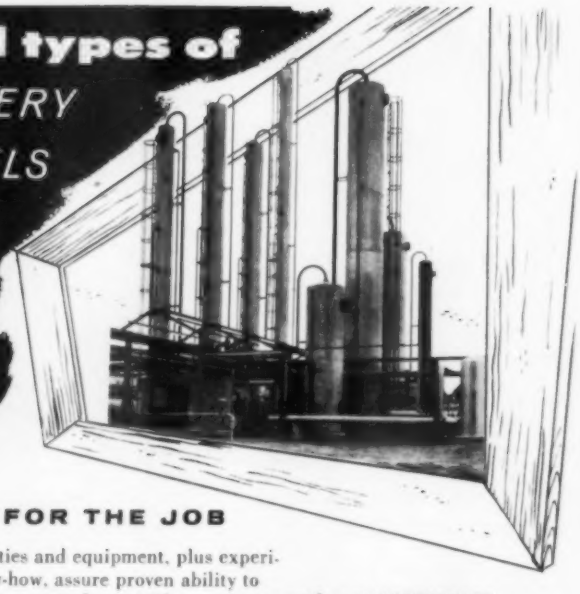

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Master's facilities and equipment, plus experience and know-how, assure proven ability to fabricate pressure vessels to rigid engineering specifications. Write — wire — phone MASTER *FIRST* for the finest in steel fabrication.

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Master also produces API 5LX HI-TEST Expanded Line Pipe

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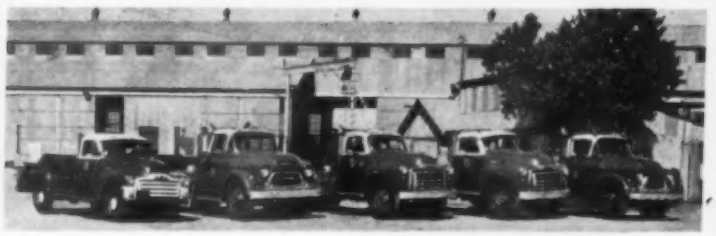

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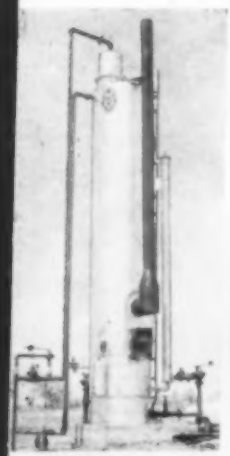

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Whatever it takes to do your job, M & V has it, or will build it!

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TANKS

SHOWCASE . . .

New Equipment

Triple-Stage Fractometer Has Wide Range

Samples containing a large number of compounds boiling over a wide range can be analyzed in one run with this new Perkin-Elmer triple-stage vapor fractometer, the company claims. The instrument is designed to take three rough cuts of a total sample without the need for preseparation and will make as many as three simultaneous analyses under optimum chromatographic conditions.

Such samples as H_2 to C_8 and C_1 to C_{18} hydrocarbon mixtures or high-boiling glycols in low-boiling alcohols reportedly can be accurately and quickly analyzed in a single operation. By using three different column substrates total separation of C_3 to C_6 saturates and unsaturates is possible.

The device can be used for low, medium, or high-temperature work. Heavy ends cannot foul the units used for medium and light end analysis, the company says.

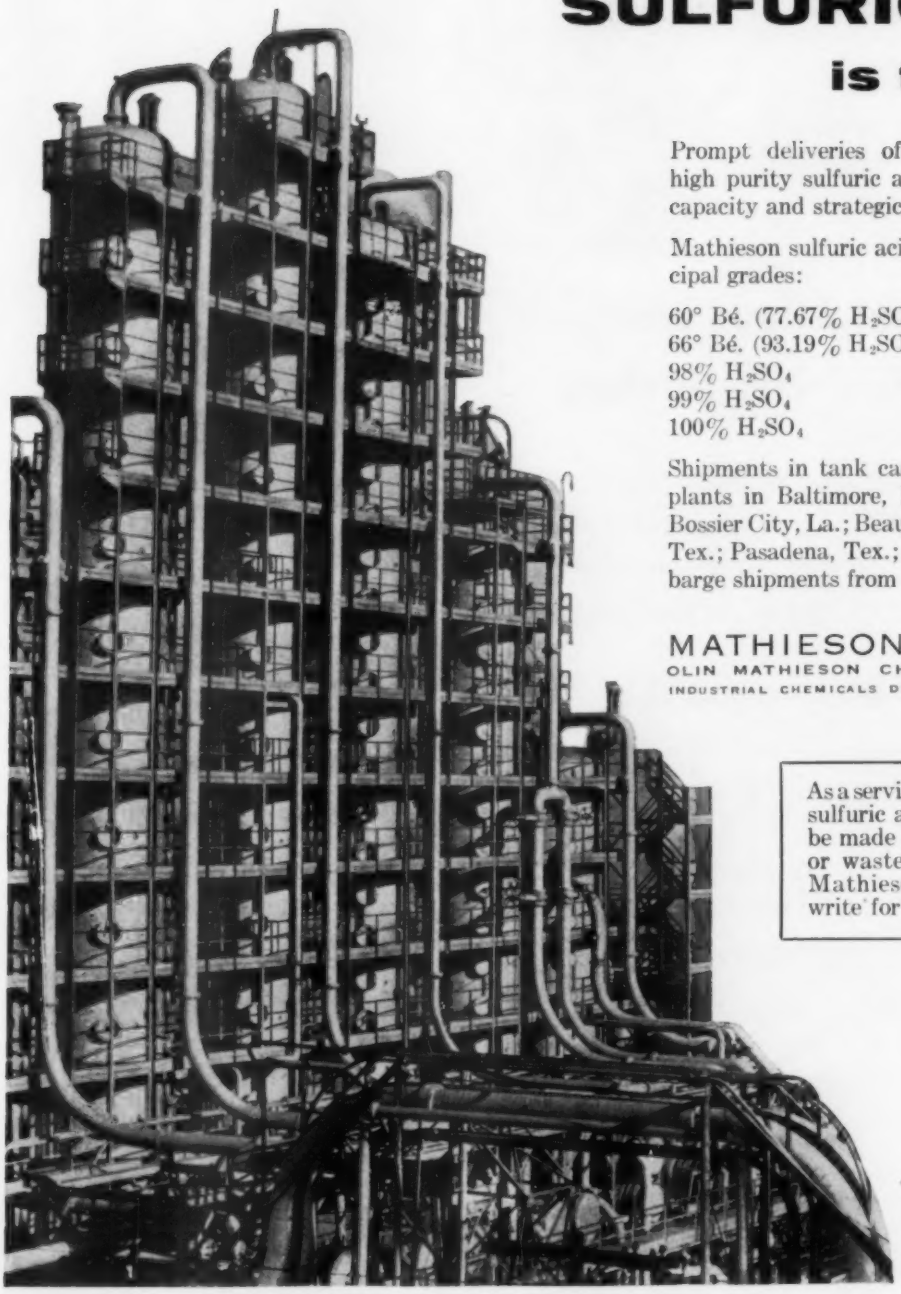
The instrument is made up of three integrated units. Each is able to accept one or two columns of total length up to 50 ft. and to permit independent control of flow, temperature, and detector voltage. Each unit may be operated in series with adjacent units or as separate units, with the option to change at any time. **Write or call: Perkin-Elmer Corp., Norwalk, Conn., for details on triple-stage vapor fractometer.**

•

Fork-Lift Truck Lifts, Moves 20,000 Lb.

Fast handling of pipe or other heavy loads is offered by this new outdoor truck with a 20,000-lb. capacity. Named the CY-200, the machine has a planetary-drive axle and 10.00 by 20-in.

when fine petroleum products are processed



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SULFURIC ACID
is there

Prompt deliveries of Mathieson's uniformly high purity sulfuric acid are assured by large capacity and strategic plant locations.

Mathieson sulfuric acid is available in all principal grades:

60° Bé. (77.67% H_2SO_4)
66° Bé. (93.19% H_2SO_4)
98% H_2SO_4
99% H_2SO_4
100% H_2SO_4
Oleum 20% (104.5% H_2SO_4)
Oleum 25% (105.63% H_2SO_4)

Shipments in tank cars and tank trucks from plants in Baltimore, Md.; Little Rock, Ark.; Bossier City, La.; Beaumont, Tex.; Port Arthur, Tex.; Pasadena, Tex.; and Palmerton, Pa. Also barge shipments from Baltimore.

MATHIESON CHEMICALS
OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

As a service to users of Mathieson sulfuric acid, arrangements can be made for the return of spent or waste acid. See your Olin Mathieson representative or write for information.

4726

MATHIESON

INORGANICS: Ammonia • Bicarbonate of Soda • Carbon Dioxide • Caustic Potash • Caustic Soda • Chlorine • Hydrazine and Derivatives • Hypochlorite Products • Muriatic Acid • Nitrate of Soda • Nitric Acid • Soda Ash • Sodium Chlorite Products • Sulfate of Alumina • Sulfur (Processed) • Sulfuric Acid

ORGANICS: Ethylene Oxide • Ethylene Glycols • Polyethylene Glycols • Glycol Ether Solvents • Ethylene Dichloride • Dichloroethylether • Formaldehyde • Methanol Sodium Methylate • Hexamine • Ethylene Diamine • Polyamines • Ethanolamines • Trichlorophenol • Surfactants

New! Low-Cost! Camco "Series K" gas-lift mandrels, tools and selectively retrievable valves handle even dual completion jobs in small casings down to 5½"—17#. Details from Camco, Inc., 7010 Ardmore St., Houston, Texas.

How Monel Alloys Improve CAMCO Gas-Lift Devices

With Monel*, "R" Monel* or "KR" Monel* Alloys, Camco "Series K" retrievable gas-lift devices are strengthened and given outstanding resistance to well corrosives and erosives

Monel is used in the valve to resist corrosion by sour crudes, brines and other well corrosives.

"R" Monel is used to do the same for valve parts which must be automatically machined at high speeds.

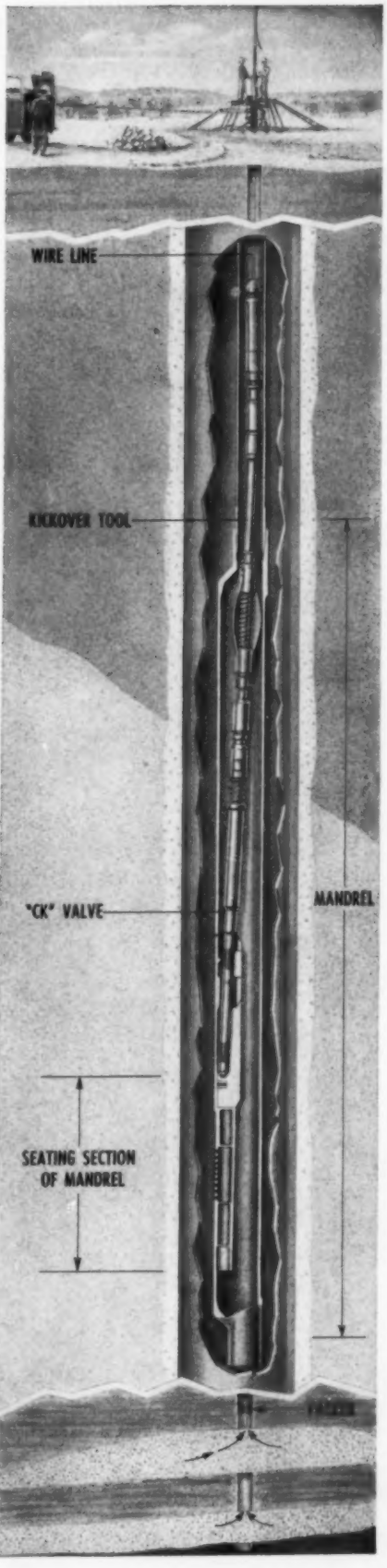
"KR" Monel is used in both valve and kickover tool where a highly corrosion-resisting alloy is needed that can be freely machined and then heat-treated to withstand wear and impact.

Monel and other Inco Nickel Alloys are used in thousands of locations and many different types of drilling and refining equipment. *They have proven uniquely resistant to corrosion, and well able to meet a wide range of severe physical requirements.* For assistance in their application, contact Inco's Development and Research Division.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO Nickel Alloys

*Registered trademarks: (1) Monel, nickel-copper alloy; (2) "R" Monel, a free machining grade of Monel; (3) "KR" Monel, an age-hardenable free machining grade of Monel.



tires for driving through mud and sand and over rough terrain.

It has continuous followup type of hydraulic power steering which operates throughout the engine speed range to permit fast, easy turning at any speed, the maker reports.

The steer axle pivots on two torsional rubber-bushing assemblies to absorb shock and provide constant ground contact on uneven terrain. Seventy-five degree wheel angularity allows sharp turns.

A Hercules JXD six-cylinder gas engine powers the machine. Engine power is transmitted by a torque converter and a four-speed power-shift transmission. Power brakes are standard equipment. The unit will travel more than 20 m.p.h. loaded in both forward and reverse and climb a 22.7 per cent grade loaded, the company claims. **Write or call: Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich., for details on Model CY-200 fork truck.**

●

Mechanical B.T.U. Meter Gives Liquid Flow Rate

Here's a completely mechanical instrument that measures heat in thermal units and liquid flow in gallons with high precision, according to the maker. Called the Pollux B.t.u. integrating meter, it can measure the heat absorbed and the heat removed from a liquid. It also can measure the heating and cooling consumed in individual areas, the maker says.

The meter has a wide range of applications. Besides its use in metering of central heating and refrigeration plants it is adaptable for use with liquids encountered in many industrial and chemical processes.

The meter consists of two parts—a liquid meter and an integrator. The liquid meter measures the flow of liquid. The integrator combines the difference between the supply and return liquid temperatures and the flow through the liquid meter to obtain a resultant product in B.t.u.'s. This product is automatically totalized on the counter. Directly above the two counters a pointer indicates the instantaneous temperature difference of the supply and return liquid in degrees Fahrenheit.

The meter is reported.y corrosion-proof, easily installed, and requires no lubrication. Where required, it can be provided with a remote counter for recording B.t.u.'s. **Write or call: Air Conditioning Equipment Corp., 219 East Forty-fourth Street, New York 17, N. Y., for details on mechanical B.t.u. meter.**

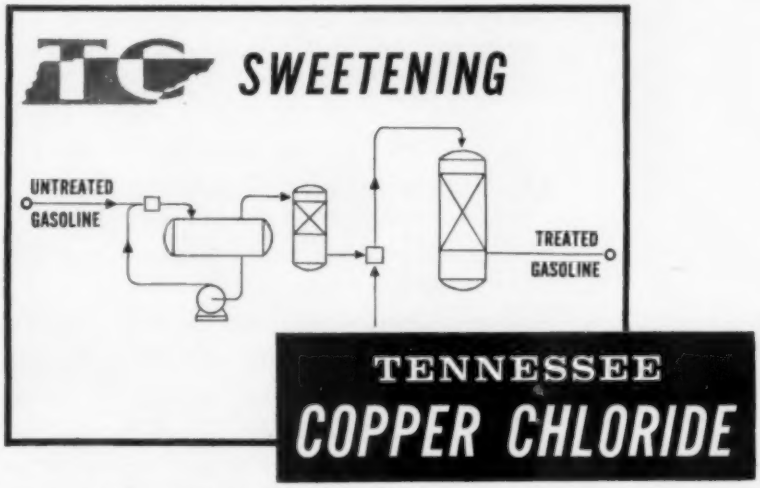
●

Explosion-Resisting Enclosures For Motor Starters

Here's a new explosion-resisting motor-starter enclosure for NEMA 7 (Class 1 Groups C and D) and NEMA 9 (Class 2 Groups E, F, and G) starters. The enclosure has threaded joints and is dusttight and weatherproof, permitting it to be used in outdoor hazardous locations, the maker reports.

Cast from high-density aluminum alloy, the enclosures consist of a collar section and an upper and lower tank. Two types of collar sections are available—one with a circuit-breaker operating mechanism and one without.

The tanks have an internal Acme thread for strength and to reduce thread damage with the tanks removed. This



Tennessee's Copper Chloride was developed to effect efficient Mercaptans removal.

Place your confidence in a basic producer of Copper Chemicals.

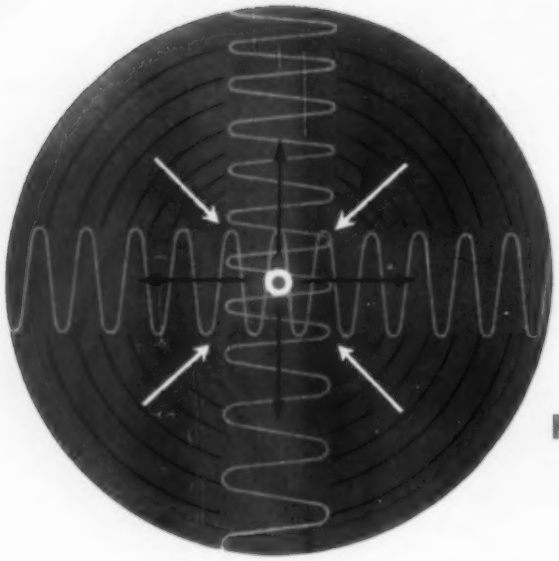
CUPRIC CHLORIDE DI-HYDRATE

Other products of interest— Ferric Sulfate—Copper Sulfate, Copper Oxide—Sulfur Dioxide.

For samples make request on your company letterhead.

TENNESSEE TC CORPORATION

617-629 Grant Building, Atlanta, Ga.



ALL-TIME HIGH ACCURACY IN ELECTRICAL LOGGING

with

HALLIBURTON'S EXCLUSIVE

FM

SYSTEM

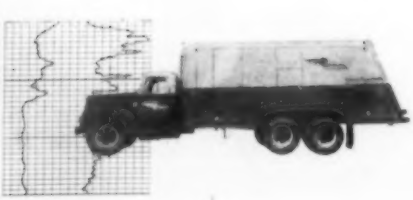
One of the most important advances in radio communication has been the development of FM... Frequency Modulation. Compared with AM, FM achieves an all-time high in fidelity, with undistorted and faithful reproduction of the original transmission.

This same FM principle is used in Halliburton's exclusive FM System of Electrical Well Logging to obtain formation information of unequalled accuracy... accuracy far surpassing that obtained with the older, conventional AM System.

Here's why Halliburton's exclusive FM logging is advantageous:

- Resistivity measurements are received from transmitters *in* the well, which helps to eliminate errors due to faulty cable conditions.
- Built-in subsurface calibration features make it possible to check accuracy of readings at any time.
- All resistivity values are measured with respect to an absolute zero.
- Temperature changes in the well have no effect on readings.
- Equipment is fully automatic making it unnecessary to touch instruments during the logging operation.

Be sure of maximum accuracy when your well is electrically surveyed ... by calling for Halliburton's exclusive FM System.



HALLIBURTON

OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

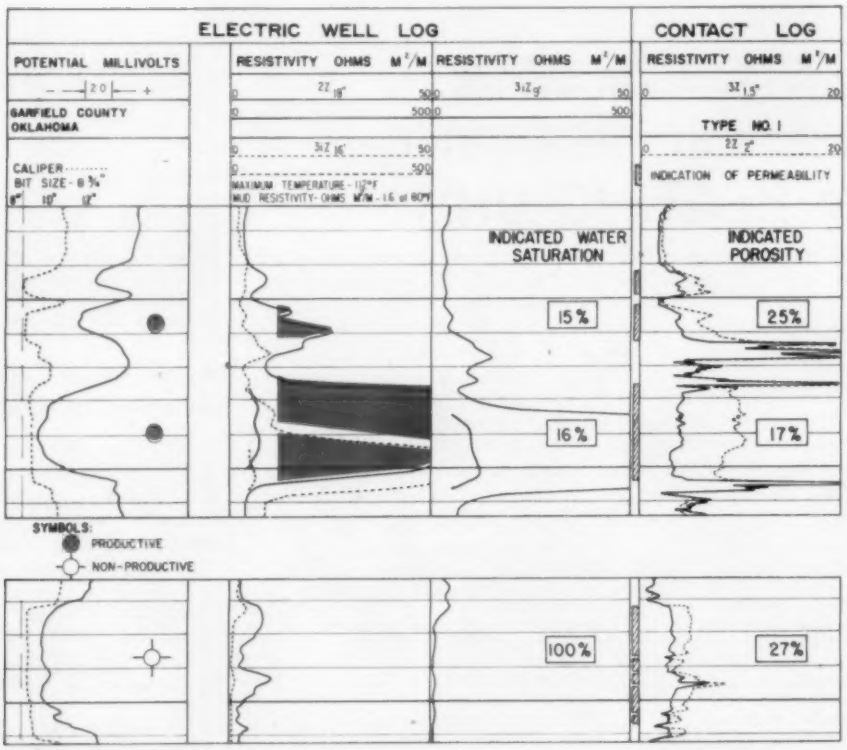
FM ACCURACY IN THIS LOG IS VITALLY IMPORTANT TO THESE MEN:

- ***GEOLOGISTS—***
  because it provides reliable correlative, lithological and stratigraphic information.

- ***PETROLEUM ENGINEERS—***
  because it provides precise, comparative reservoir evaluation.

- ***OPERATORS—***
  because it provides a permanent, reliable well record for help in planning initial completion and future services.

The decisions these men make rest heavily on accuracy... Their electric logs must be as free as possible from errors due to temperature variations and defective cable conditions... if their decisions are to result in dependable, profit-making action. That's why the industry... more and more... is turning to Halliburton's FM System of Electrical Logging, where error of transmission is near zero!

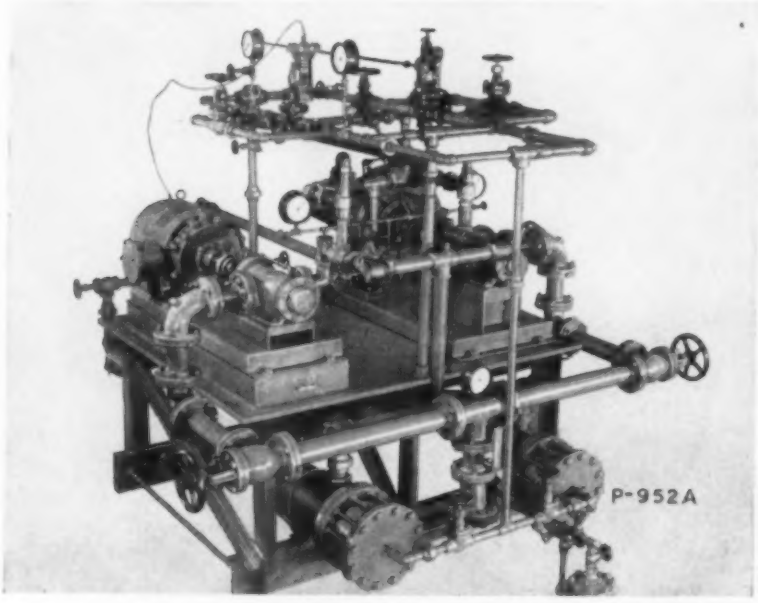


ELECTRICAL WELL SERVICES

"ELECTRONIC EYES FOR OILMEN"

COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

MORE COMPACT THAN EVER . .



P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

NATIONAL AIROIL

FUEL OIL PUMPING *AND* HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40—very interesting and informative.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
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COMBINATION GAS & OIL BURNERS
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FURNACE RELIEF DOORS
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SPECIAL REFRACTORY SHAPES

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MAIN OFFICE AND FACTORY:
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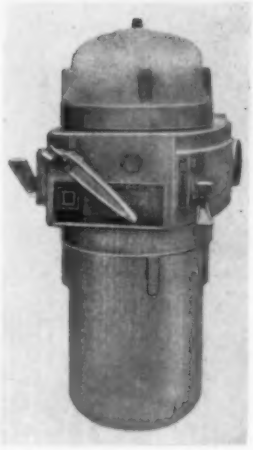


threading also prevents the entrance of rain when installed. A plugged-and-tapped opening in each tank is provided for adding a drain and breather.

Two sizes of enclosures are now available—one for NEMA Size 0 or 1 starters and the other for NEMA Size 2 starters. **Write or call: Square D Co., 4041 North Richards Street, Milwaukee 12, Wis., for Bulletin 9990.**

•

Motor-Phase Converter Operates from Single-Phase

Here's a combination motor-phase converter for operating oil-well pumps. It comprises a polyphase all-climate oilfield motor and an autotransformer converter permitting operation of pumps from a single-phase power line. The unit features a built-in magnetic starter, remote off-on switch, built-in synchronous time switch, and lightning arresters. It comes in sizes of 1 to 30 hp. at speeds of 1,800, 1,200 and 900 r.p.m.

According to the maker, the motor provides a high torque. And it has a high overload capacity. Called the Power Twin, the unit is said to be simple to install. It requires no field adjustments. **Write or call: System Analyzer Corp., Nokomis, Ill., for details on Power Twin.**

SHOWCASE . . .

New Literature

Hydraulic Truck Cranes for saving time and cutting costs on a variety of jobs are described and illustrated in new Ruger Catalog 605. The four-page catalog shows how the hydraulic cranes, available in capacities of ½, 1, and 2 ton, provide a convenient way for hoisting and moving a variety of equipment and pipe. One page of the catalog contains an annotated diagram giving the specifications for three models of the crane. **Write or call: Ruger Equipment, Inc., 615 West Fourth Street, Uhrichsville, Ohio, for Catalog 605.**

●

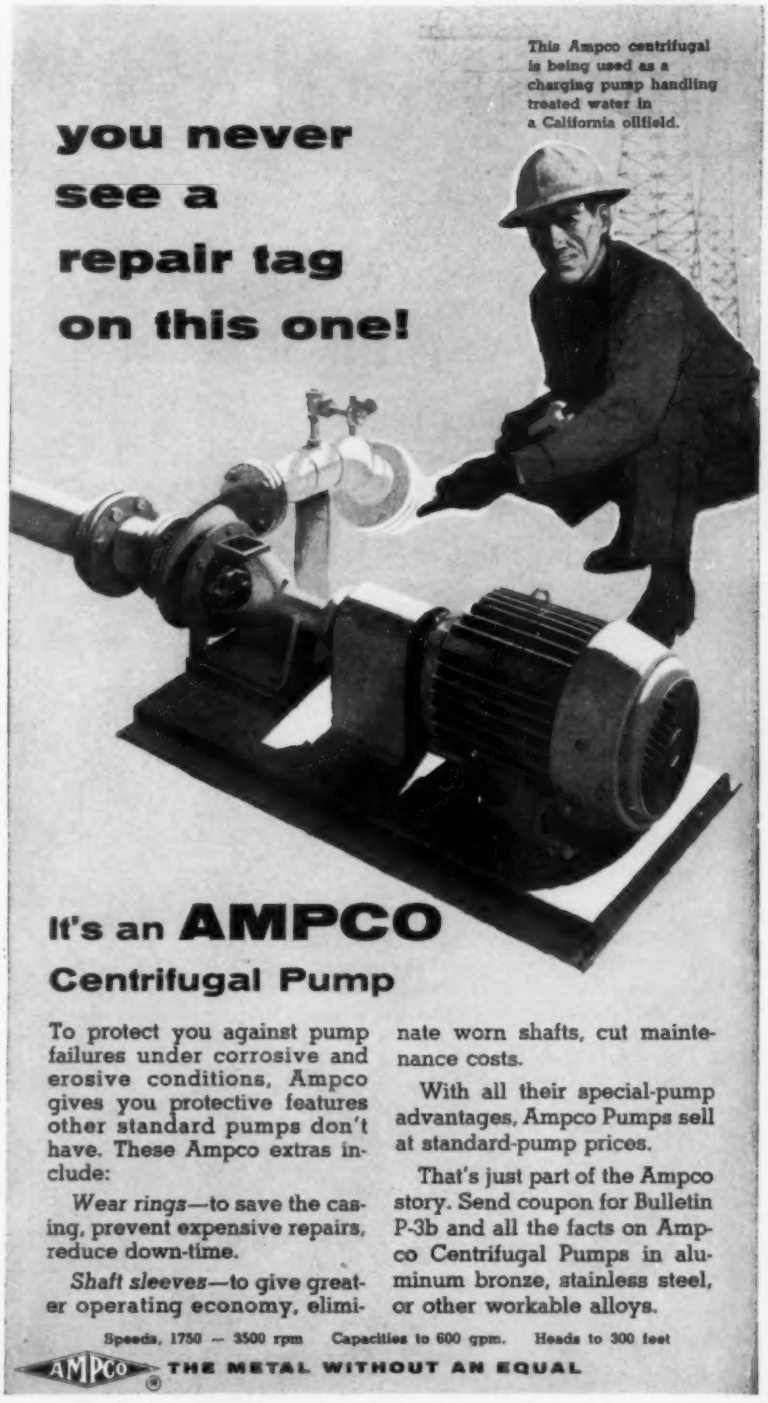
Vinyl Coating, sprayable at a 45 per cent solids content, is described in this new two-page data sheet. According to the data sheet, the coating permits a film thickness of 5 mils to be attained easily. The coating can be sprayed by either a cold or hot-spraying technique. The data sheet lists complete specifications for the Lankote 200-H coating, including its properties in both the liquid and dry state. **Write or call: J. Landau & Co., Inc., Carlstadt, N. J., for data sheet on Lankote 200-H coatings.**

●

Continuous Specific - Gravity Measurement of a liquid sample with a Potter Series 27 Densimeter system is set forth in new four-page Leaflet S4. The leaflet describes the principle of operation involved in the densimeter and illustrates and explains how it is installed. A table lists complete specifications for the instrument. According to the table, the density meter handles a specific-gravity spread of 0.3 within a specific-gravity range of 0.6 to 1.2. Temperature limits are 0° to 180° F. The pressure limit is 600 psi. for one model and 2,000 psi. for the second model. **Write or call: Potter Aeronautical Corp., U. S. Route 22, Union, N. J., for Leaflet S4.**

●

Liquid - Level Measurement without floats or other moving parts through the use of a Bogue liquid-level indicator is described in new eight-page Bulletin S-68B. The bulletin describes two types of the instrument—one for use in applications where manual calibration may be used; the other for use in applications requiring precise level measurements free of errors caused by temperature and gravity variations within the liquid. Applications listed for the indicator include tank farms and proc-


This Ampco centrifugal is being used as a charging pump handling treated water in a California oilfield.
you never see a repair tag on this one!
It's an AMPCO
Centrifugal Pump
To protect you against pump failures under corrosive and erosive conditions, Ampco gives you protective features other standard pumps don't have. These Ampco extras include:
Wear rings—to save the casing, prevent expensive repairs, reduce down-time.
Shaft sleeves—to give greater operating economy, eliminate worn shafts, cut maintenance costs.
With all their special-pump advantages, Ampco Pumps sell at standard-pump prices.
That's just part of the Ampco story. Send coupon for Bulletin P-3b and all the facts on Ampco Centrifugal Pumps in aluminum bronze, stainless steel, or other workable alloys.
Speeds, 1750 — 3500 rpm Capacities to 600 gpm. Heads to 300 feet
AMPCO
THE METAL WITHOUT AN EQUAL

AMPCO METAL, INC., Dept. OGJ-9, Milwaukee 46, Wisconsin
West Coast Plant: Burbank, California

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Send me
Bulletin P-3b

P-29

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Yes!

THOMPSON *makes* SAND-RESISTANT OIL WELL PUMPS

SELF-ALIGNING SAND SEALED-OFF PUMPS

Figs. 600-800-900

Inverted Combination Single or Double Plunger Self-Aligning Pumps can be equipped with a Sand Flush Valve which seals the Plunger off on top and cleans the barrel every pump stroke.

Sand is deposited into blind cage above the plunger and is discharged every stroke of the pump. The bottom of plunger is sealed to eliminate slippage. Easy on surface equipment. Lower lifting cost with Sealed-Off Pumps.

Can be run in any API seating device or use an adapter to fit the seating device preferred. We carry in stock at all times Special Heavy Duty Sand Housing Mechanical Seating Shoes which are very important to bad sand conditions—a place for sand to settle, so when pump is on down stroke, the bottom barrel bushing with a double spiral spray reaches into the sand housing, moving the sand upward and out of the tubing with the oil.

Figs. 600-800-900

THOMPSON
PUMP COMPANY
OKMULGEE, OKLAHOMA

IMPORTANT ANNOUNCEMENT

to the

PETROLEUM INDUSTRY

In commemoration of
Oklahoma's 50th Anniversary
The Oklahoma Publishing Co.
is publishing

FIVE SEMI-CENTENNIAL EDITIONS

October 13, 20, 27 & November 3 & 10

The first of these sections is
dedicated to the Petroleum Industry
in coordination with the
celebration of

OIL PROGRESS WEEK

October 13

edited by

CLAUDE BARROW

well-known Oklahoman Oil Editor

Because of the importance of the oil industry to Oklahoma in its first 50 years of statehood, the publication of this first Semi-Centennial Edition, October 13, is planned to coincide with national Oil Progress Week. The oil industry and its suppliers all should be represented with advertising in this Semi-Centennial Edition of The Sunday Oklahoman.

For space reservations, contact
The Katz Agency or the advertising
department of The Oklahoman & Times

THE DAILY OKLAHOMAN
OKLAHOMA CITY TIMES

published by
The Oklahoma Publishing Company
represented by
The Katz Agency

essing plants. **Write or call: Bogue Electric Mfg. Co., Paterson 3, N. J., for Bulletin S-68B.**

•

Oil-Tool Catalog. This new catalog illustrates and describes every item in the line of Page tension tools, with particular emphasis on tubing anchors, tubing drains (both mechanical and hydraulic), and bottom-hole oil-and-gas separators. The catalog also describes automatic well-flow controllers and sampling or shutoff valves. **Write or call: Page Oil Tools, Inc., 3356 Lime Avenue, Long Beach 7, Calif., for oil-tool catalog.**

•

Principal Ball-Bearing Types and fundamentals of bearing mounting are described in this New Departure bearing application manual, Part 1. The 24-page manual, conveniently indexed, covers 21 different subjects, including features common to the basic bearings, general mounting rules, application of single-row bearings, and bearing preloading and its effects on housing fits and bearing life. **Write or call: New Departure Div., General Motors Corp., Bristol, Conn., for manual, "Ball Bearing Application," Part 1.**

•

Corrosion - Resistant Tank Thermometer. Designed for use where chemical action of such compounds as aromatic hydrocarbons or petroleum products is critical is set forth in new Bulletin S-54, a two-page data sheet. The thermometer has a one-piece cup case molded of smooth heat-resistant plastic with a low thermal conductivity. The 120-ml. cup capacity is said to meet the requirements of both A.S.T.M. and A.P.I. Temperature ranges offered are from —40° to 500° F. Graduations are permanently engraved on a 14-in. red-reading wide-bore tube. **Write or call: Weksler Thermometer Corp., 195 East Merrick Road, Freeport L. I., N. Y., for Bulletin S-54.**

•

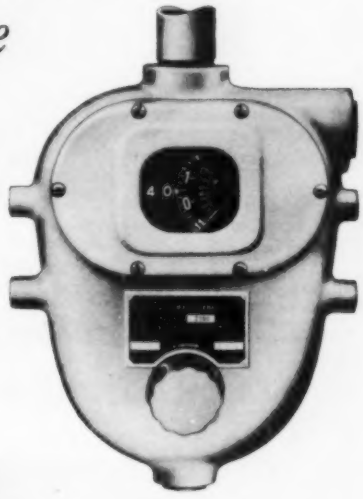
Drilling Equipment for water, oil, minerals, and gas is covered in this new 164-page catalog titled, "Drilling Holes." The catalog describes the complete line, including specifications and working data, on Stardrill-Keystone, Franks, and Acme machines and equipment. The equipment includes percussion and combination machines, rotary machines, and percussion and rotary tools. In addition to mechanical specifications, the catalog includes performance charts under actual field conditions. It also has information on reverse circulation, hydraulic bit-dressing

7000 SOLD in 7 YEARS!

That's the Field-Tested record of the

"Varec"

FIGURE NO. 2500 SERIES



AUTOMATIC TANK GAUGE

Patent No. 1,879,805
Patent No. 2,555,593
Other Patents Pending

Seven solid years of proven service stand behind the "Varec" Fig. 2500 AUTOMATIC TANK GAUGE. It was first with the NEG'ATOR MOTOR — a feature so good that competition copies. It's not new it's been tested for seven years. Because it is a long-deflection constant force element it is *not* a spring — It is a motor!

When you have to squint into a look-box, even if the gauge tape is clean, you are subject to parallax — (if you are tall, you read the tape *low*; if you are short you read the tape *high* . . . that's parallax). A mis-reading of 1/8 inch can cost you or your customer many barrels of oil on a large tank. Accuracy is assured with the "Varec" Counter and Dial System (Patent claim allowed but not yet issued — other patents pending). Gravity Compensator adjustments made at counter assembly without exposure to tank vapor or pressure. Tank vapors sealed off from counter assembly. Removal of front cover plate will not de-pressure tank. Patented operation checker for testing gauge operation.

There is a Fig. 2500 Series gauge for every type of installation.

Tell your "Varec" representative your gauging problem, our Engineering Department will come up with the correct answer. You will have a gauge that leads the field — that stands for quality and accuracy first and it will cut your "unaccountable losses." That's why the "Varec" Fig. 2500 has a fast "pay-out."

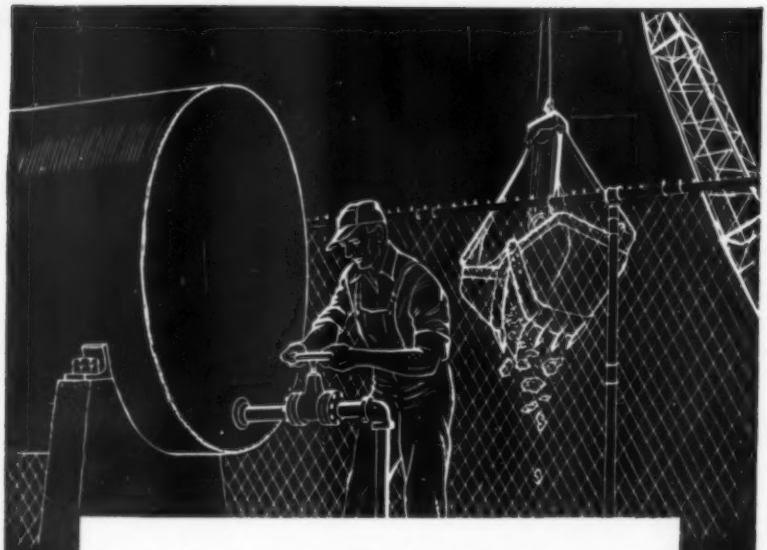
Send for free Bulletin CP-3502 for full information

"Varec"

961-23

THE VAPOR RECOVERY SYSTEMS COMPANY
2820 North Alameda Street
P.O. DRAWER 231
Compton, California

Cable Address:
Varec Compton Calif. (U.S.A.) All Codes



A new plant next door can increase FIRE HAZARD on your side of the fence!

As industrial areas grow more crowded, the need for complete fire protection mounts. To the normal hazards in your own plant must be added those of new neighbors. Be sure that your flammable liquids are protected! Ask for specialized suggestions from National Foam.

NATIONAL FOAM System, Inc.
West Chester, Pa.

NATIONAL FOAM FIRE PROTECTION SYSTEM

The only company exclusively engaged in the design, development and manufacture of foam fire protection equipment and chemicals.

equipment, and field procedures on drilling, tool dressing, tempering, and handling. All significant figures are accompanied with conversions to their metric equivalents. **Write or call: Stardrill-Keystone Co., Beaver Falls, Pa., for catalog, "Drilling Holes."**

●

Tape - Wrapping Machine described in this new four-page brochure provides the precise controlled performance necessary to the application of tape on pipelines, the brochure points out. The illustrated brochure gives specifications and construction details on two power-operated and three manually operated tape-wrapping machines. **Write or call: Plicoflex, Inc., 5501 Santa Fe Avenue, Los Angeles 58, Calif., for brochure.**

●

Junk Basket, a two-catcher junk fishing and coring device, is described in this new four-page folder. The tool is designed to simplify fishing and make possible a one-trip operation, according to the folder. The folder includes cutaway drawings and a complete description of the tool, its parts, and their prices. A sintered-carbide-dressed shoe is shown in detail, as well as mill type and flat-bottom shoes. **Write or call: Bowen-Itco, P. O. Box 4587, Houston 13, Tex., for folder on junk basket.**

●

Long-Stroke Hydraulic Pumping Unit permitting a stroke of up to 12 ft. is described in new Texsteam Catalog TL-571. The eight-page catalog gives the sizes and specifications for two models with respective maximum polished rod loads of 9,500 and 15,000 lb. One valuable feature of the catalog is a full two-page nomograph that makes it simple to determine the proper size pumping unit and prime mover for any well conditions. **Write or call: Texsteam Corp., P. O. Box 9127, Houston 11, Tex., for Catalog TL-571.**

●

Cut-in Valve and Sleeve designed to simplify the problem of installing gate valves in any existing piping which can be relieved of pressure is described in this new four-page folder. A series of photographs shows how the valve and sleeve is installed. According to the folder, the only equipment needed to install the valve is an open-end rachet type of wrench, gaskets, follower rings, bolts, and nuts. An annotated drawing and tables give available valve sizes, dimensions, and working-pressure ratings. **Write or call: A. P. Smith Mfg. Co., East Orange, N. J., for bulletin on cut-in valve and sleeve.**

EQUIPMENT MEN . . . in the News

Union Tank Car to Acquire Phoenix and Graver Tank

Union Tank Car Co. of Chicago and Phoenix Manufacturing Co. of Joliet, Ill., have announced that the directors of both companies have approved an arrangement under which Union Tank Car will acquire all the assets of Phoenix, including the stock of its wholly owned subsidiary, Graver Tank & Manufacturing Co., Inc., of East Chicago. The stockholders of Phoenix will be asked to approve the action proposed by their directors. The transaction calls for the issuance of previously authorized but unissued Union Tank Car stock on the basis of 2.1 shares of Union Tank Car for 1 share of Phoenix.

Union Tank Car owns and leases to shippers of liquid products in this country and Canada a fleet of more than 52,600 tank cars. Since 1949 Graver has produced virtually all the tanks used by Union Tank Car in the United States.

Graver, now celebrating its 100th anniversary, is a leading fabricator of field-erected tanks and also produces pressure and process equipment in all alloys. The firm also has a water-conditioning division which provides design and engineering services for industrial water and power plants. Graver Construction Co., Inc., is a subsidiary which serves as contractor for industrial plants and plant units.

E. N. Gosselin will continue as chief executive officer of both Phoenix and Graver. B. C. Graves is board chairman and E. A. Locke, Jr., president of Union Tank Car.

Independent Perforators Names General Manager

B. J. STORSETH

B. J. Storseth has been appointed general manager of Independent Perforators, Inc., of Stillwater, Okla. Storseth has been with Lane-Wells Co. since 1948. He has been in sales engineering work and has spent 2 years in Illinois and 7 years in Oklahoma.

W. D. (Bill) Greene, who has been with Lane-Wells 11 years, has resigned from that company to become service manager of Independent Perforators, Inc.

J&L Supply Occupies New Store Building at Casper

Rainey Elliott, president of Jones & Laughlin Supply Division headquartered in Tulsa, has announced the recent move of the firm's Casper, Wyo., oil-field supply store to this new 5,600-sq.-ft. building housing a storeroom, warehouse, store office, three sales offices and a pump shop. A 3,200-sq.-ft. overhead dock above the storeroom and offices gives the firm a total of 8,800 sq. ft. of usable floor space.

Personnel assigned to the Casper store are Glenn E. Best, assistant district sales manager, South Rocky Mountain district; Curtis L. Sample, local store manager; Carl J. Watson, machinery engineer; Jack Bastian, city salesman; Hanson L. Rikard and Lloyd V. Page, field salesmen; Jack W. Payne, sales trainee; and storemen Jimmy A. Rogers, Garland R. Cain, William T. Fleming and Otis P. Johnson.

The Casper store is under the over-all supervision of D. H. Carson, district sales manager, South Rocky Mountain district, with headquarters at Denver, Colo.

Officer Joins Staff of Gravity Meter Exploration

Charles B. Officer, Jr., research geophysicist and geologist, has joined Gravity Meter Exploration Co. in Houston. He also will participate in activities of two other firms affiliated with GMX, GMX Corp., and Geophysical Associates International.

Officer has specialized in various aspects of marine geophysics and geology, underwater sound transmission, wave and ray propagation, tectonics and structure of the earth. He was with Woods Hole Oceanographic Institution from 1951 to 1955, going to Rice Institue later in 1955.

Dresser's J. B. O'Connor To Open Greek Barite Mill

J. B. O'Connor, president of Dresser Industries, Inc., Dallas, and chairman of the board of Magnet Cove Barium Corp., is en route to Mykonos, Greece, to formally open a barite processing plant there. This first commercial venture on the resort island will provide high-grade barite for Magcobar, one of the Dresser Industries. After the barite has been processed into Magcobar drilling mud, it will be supplied to oil drillers in Europe, the Middle East, North Africa and elsewhere throughout the world.

The Mykonos operation will contribute toward Dresser's goal of international sales totaling over $100,000,000 annually by 1959.

PGAC Opens Five Stations, Transfers Personnel

R. M. Haynie, with the company 7 years, has been transferred from Perforating Guns Atlas Corp.'s Greggton, Tex., station where he was district manager, to the same position at the company's new office at Shreveport, La. Lee Buel, field engineer, has been transferred from the station at Houma, La., to be in charge of the company's new station at Buras, La. He has been with PGAC 3 years.

J. E. Crouch, with PGAC 7 years and formerly field engineer at Lafayette, La., has been put in charge of the new station at Magnolia, Ark. John S. Rhodes has been transferred from the Odessa station and made district manager of PGAC's new station at Farmington, N. M. W. E. McCarroll, salesman, has been transferred to the company's new station at Crane, Tex. He has been with the company 6 years and was formerly at the Odessa station.

Charles B. Melvin, with PGAC 9

years and previously district sales representative at the Graham, Tex., office, has been promoted to district manager in charge of the Panhandle district with headquarters at the company's station at Pampa, Tex. James H. (Buddy) Rodgers, with the company 9 years and formerly a district sales representative at the Victoria, Tex., station, has been promoted to district manager of PGAC's new station at Laurel, Miss.

The company's offices at Tulsa have been moved to the Mid-Continent Building. James T. Brockman is the salesman in charge of the Tulsa office.

Maloney-Crawford Elects Executive Vice President

H. WOTKYNS

Haskell Wotkyns has been elected executive vice president of Maloney-Crawford Tank & Manufacturing Co., Tulsa, according to George L. Hudson, president of the oil-producing equipment manufacturer. Wotkyns was previously Mid-Continent sales manager of Abegg & Reinhold Co., Houston. Prior to that he was vice president and Mid-Continet division manager of Baash-Ross Tool Co.

Westinghouse Expands Carrier-Microwave Facilities

The carrier-microwave department of Westinghouse Electric Corp. has expanded its facilities in Halethrope, Md., by constructing this new office building adjacent to the manufacturing plant. By moving administrative, sales, engineering, purchasing, and accounting offices into the new building, the manufacturing area is increased 17 per cent. Expanded and improved engineering laboratory facilities are now available also. Many processes formerly done elsewhere are now done within the plant.

Glover Heads Newly Formed Jefferson Chemical Group

Formation of a new division of Jefferson Chemical Co.'s marketing department has been announced by Donald L. Griswold, general manager of the department. The move combines the market research division and the sales research and development division into a new group to be called the commercial development division. John J. Glover has been appointed manager.

All functions of product development and market research will be handled by the new division, including product diversification and development of new sales.

Glover has been manager of market research since 1955. He has served in various positions in Jefferson since joining the company in 1949.

Franklin Supply Names Farrell as Vice President

James E. (Ed) Farrell has been appointed as vice president of Franklin Supply Co., Chicago. He will be responsible for the company's operations in New Mexico, Louisiana and Texas.

Krickl to Head Badger's Manufacturing Activities

Anson W. Krickl has been appointed general manager of manufacturing by Badger Manufacturing Co., Cambridge, Mass. He will be responsible for manufacturing activities connected with the production of Badger service-rated expansion joints and water distillation equipment. He will be located at the firm's headquarters in Cambridge.

Krickl comes to Badger from Catalytic Construction Co. From 1937 until 1953 he served in various process and project engineering and sales executive activities for E. B. Badger & Sons and its successor, Badger Process Division of Stone & Webster.

Mid-Continent Completes Farmington Store Building

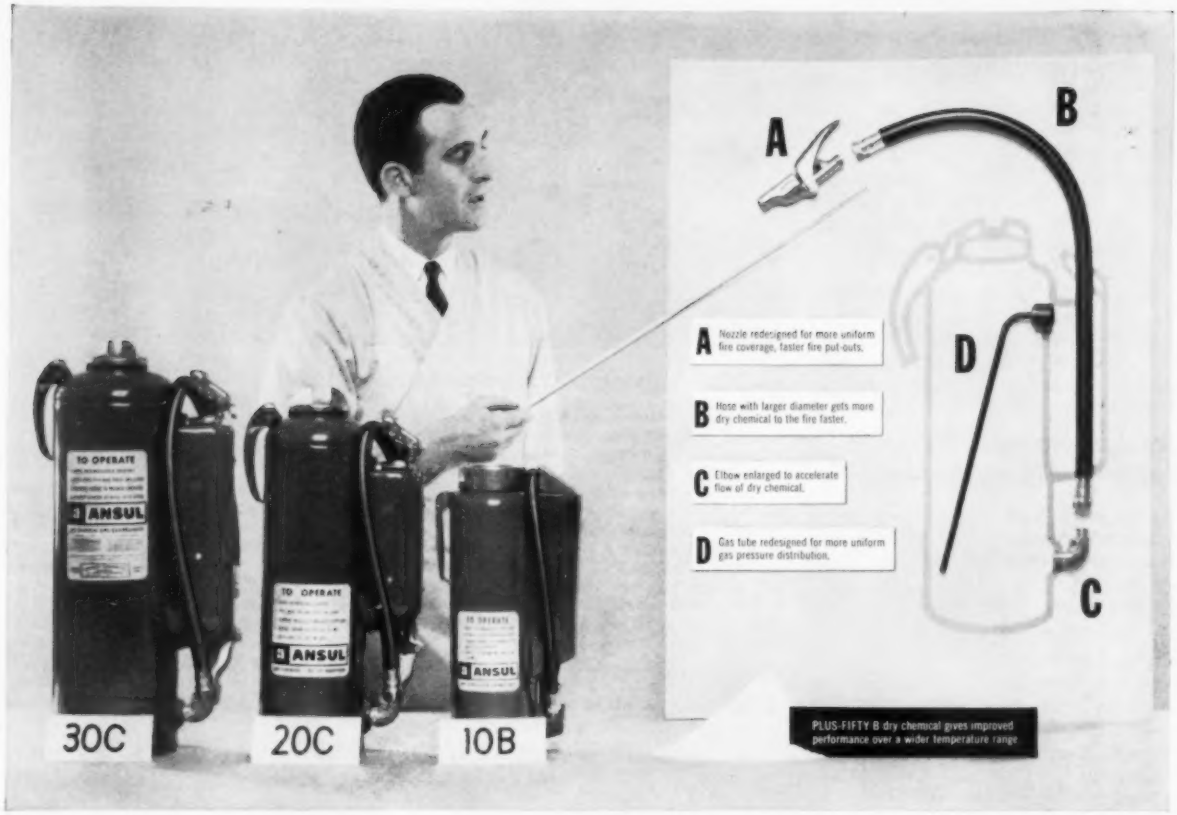
This new supply store building has been completed at Farmington, N. M., by Mid-Continent Supply Co. President Ken W. Davis also announced opening of a district office at Farmington. Shown in the inset photographs are Farmington District Manager C. D. McIver (left) and Store Manager H. T. Branum. The Farmington district is part of Mid-Continent's Rocky Mountain division, headed by Division Manager W. W. Arnold.

The new building has a large parking area and storage yard for pipe and machinery. The store carries a complete stock of parts and equipment to serve the San Juan basin. Mid-Continent first opened a supply store in Farmington in 1950. The Farmington district office controls Mid-Continent's operations at Farmington and Cortez and Grand Junction, Colo.

Hammond Appoints Walker As Pittsburgh Sales Mgr.

Max G. Walker has been appointed sales manager of the Pittsburgh office, according to Ralph E. Kramer, vice president of Hammond Iron Works. The company is a prominent designer, fabricator and erector of steel plate vessels and tanks. Hammond plants are located at Warren and Bristol, Pa.; Birmingham, Ala.; Provo, Utah; and Casper, Wyo.

Walker was formerly southeastern sales manager for the company with headquarters in Birmingham. Prior to joining Hammond, Walker spent 6 years as Chicago district sales manager for Murphy Diesel Co.


A
B
C
D
A Nozzle redesigned for more uniform fire coverage, faster fire put-outs.
B Hose with larger diameter gets more dry chemical to the fire faster.
C Elbow enlarged to accelerate flow of dry chemical.
D Gas tube redesigned for more uniform gas pressure distribution.
PLUS-FIFTY B dry chemical gives improved performance over a wider temperature range
30C
20C
10B
TO OPERATE
ANSUL

Important design improvements in these Ansul Extinguishers give you more fire fighting power at no increase in price. Three years of research and more than 2000 fire tests turned up some significant new information on dry chemical extinguishment. Ansul engineers were able to design these findings into three new extinguisher models, the 10B, 20C and 30C. Result, greatly increased fire fighting power. All Ansul equipment is backed by a five-year warranty. This is the best way we know to say Ansul fire extinguishers are the finest of their kind made anywhere.

ANSUL

The Ansul Chemical Co., Marinette, Wisconsin

Pennsalt Chemicals Names Southwestern Distributor

Mexico Refractories Co. of Texas has been named distributor of Pennsalt Chemicals Corp.'s corrosion engineering products in Texas, southern Arkansas, and western Louisiana. Headed by General Manager L. L. Brightman, the company's main office and warehouses are at Houston.

In addition to handling Pennsalt's line of corrosion-resistant mortars and protective coatings, Mexico Refractories will carry local stocks of companion products including acid-resisting brick.

Brooks Rotameter Names Keller as Chief Engineer

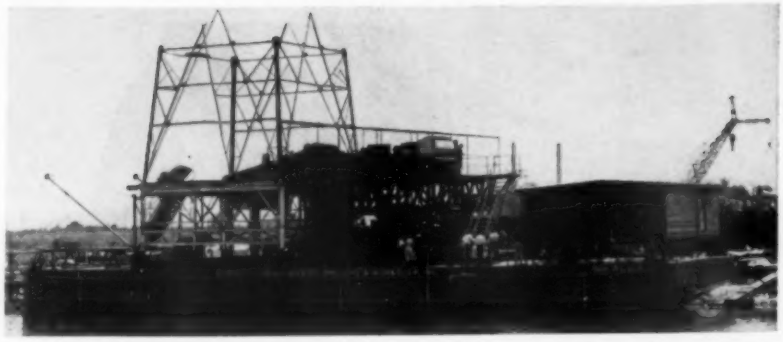
George D. Keller has been named as chief engineer for Brooks Rotameter Co. He has had 12 years of practical experience in engineering and sales in the instrument industry. He was recently with Penn Industrial Instrument Corp. as vice president and general manager.

Brooks Rotameter Co. has recently moved to a new 27,000-sq.-ft. plant in Hatfield, Pa.

Venatta to Manage Oronite Oak Point, La., Plant

W. K. Venatta has been promoted to manager of Oronite Chemical Co.'s Oak Point, La., plant, according to T. G. Hughes, president. Venatta succeeds T. I. Clausen, who is being transferred to California Research Corp. Venatta will be responsible for the manufacturing, distribution and purchasing operations in connection with the production of lube-oil additives, gas odorants, dispersants and other products of the Oak Point facility.

In 1948, shortly after Oronite Chemical Co. was formed, Venatta was appointed manager, product control. His responsibilities in this position were later expanded to include direction of worldwide distribution of Oronite products.



Marine Fabricating Completes Barge for Burdett-Edman

Marine Fabricating & Engineering Co. of Houston recently completed another marine drilling vessel with the commissioning of the drilling barge, Mr. Alex, constructed for Burdett-Edman Marine Drilling & Workover, Inc., of Houston. Mr. Alex is the fourth vessel completed since January.

Among those present at christening ceremonies were Dee Burdett and Douglas Edman of Burdett-Edman Marine Drilling & Workover; Clarence Sprague, president of Marine Fabricating & Engineering; Alex August and Tony Mitchell, Republic Supply Co.; George Feingold, Bill Cook, and Bob Schuller, MFE general superintendent, chief engineer and naval architect, respectively. Also present were representatives from Tidewater Oil Co., Humble Oil & Refining, and Pan American Petroleum Corp.

Mr. Alex is designed for operation in water depths from 4 to 11 ft. and is capable of drilling new wells to a depth of 11,500 ft., and workovers to any depth. The vessel is 142 ft. long, 35 ft. wide and 12 ft. deep.

Dowell Names Two to Design Engineering Posts

F. M. Winn and C. A. Pitts, formerly in Dowell's mechanical research department at Tulsa, now head sections of the company's design engineering department, according to Dr. W. W. Love, Dowell research director. The department will be under the direction of E. J. Echols, chief design engineer.

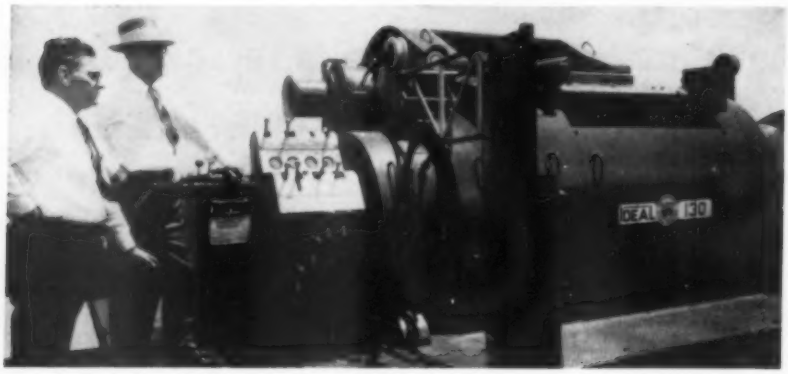
F. M. WINN

C. A. PITTS

As design engineering supervisor, Winn will be in charge of design of field servicing equipment and development of designs for construction of all bulk materials handling, field storage and chemical transportation equipment. M. M. Moore is the new project engineer in charge of this activity.

The field design section, supervised by C. A. Pitts, field design engineer, will be concerned mainly with field equipment problems and improvements of design and will supply field information when new equipment design is contemplated.

Winn, who joined the firm in 1953, has been with Dowell's engineering and technical developments and more re-



National Rig to Drill for Bolivian Gulf Oil Co.

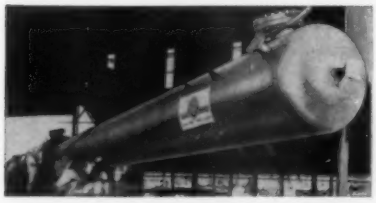
A. C. Hatfield (right), drilling superintendent of Bolivian Gulf Oil Co., and E. Richards, tool pusher, inspect the company's new National Type 130 rig as it was rigged up in National Supply Co.'s Houston plant prior to shipment to southern Bolivia.

The picture was taken on the derrick floor, 15 ft. high. A four-section drive group, powered by four General Motors torque-converter equipped engines, is on an engine foundation 6 ft. 10 in. high. Slush pumps and mud tanks are at ground level.

The rig which includes a 136 by 30-ft. derrick, is now moving to a wildcat location at Mandeyapecua, Santa Cruz, near the Paraguayan border.

cently was a project supervisor in the mechanical research department. Pitts has had field engineering and drilling experience in the United States and Venezuela. He joined Dowell in 1953, and has been in Tulsa the past year.

Master Building Gasoline Plant for Liquigas Co.



Current expansion plans of Liquigas Co., Knox City, Tex., include the installation of several towers. The second and largest to date of these major towers was fabricated by Master Tank & Welding Co., Dallas, and left Master's pressure vessel construction shop recently atop two 60-ft. flat cars.

Fabricating refinery and gasoline plant towers is not a new production venture at Master Tank & Welding. This 80,000-lb. pressure vessel measured 110 ft. long, was 48 to 72 in. i.d., and required 2,700 man hours to produce.

Gustin-Bacon Names Mohr Manager, Industrial Sales

C. W. Mohr has been appointed manager of the industrial sales department of Gustin-Bacon Manufacturing Co. He will be responsible for marketing of the company's industrial materials which include Rolagrip, Gruvagrip and Gruvajoint couplings and fittings.

Before coming to Gustin-Bacon, Mohr was sales manager of the oil-equipment division, Milwaukee Valve Co.

Stone & Webster Names Chief Chemical Engineer

Theodore E. Casselman, Jr., has been appointed chief chemical engineer of Stone & Webster Engineering Corp., according to Fred W. Argue, vice president and engineering manager.

Casselman joined Stone & Webster in 1935 as a project engineer and was promoted to senior project engineer in 1953. He has been engaged in the design and engineering of various chemical, petroleum, gas and other industrial plants being built by Stone & Webster in the U. S. and abroad.

Before joining Stone & Webster, Casselman worked as an engineer for Worthington Corp., Jackson Engineering Corp., and American Locomotive Co.

Cook Testing Adds Three Branch Service Locations

R. M. Cook, president of Cook Testing Co., Long Beach, Calif., has announced the addition of three new branch service locations at Farmington, N. M.; Blanding, Utah; and Avenal, Calif. The addition of these branches brings the total to 10 locations in western, Mid-Continent and Gulf Coast fields for Cook Testing service.

Visco Products Awards Plant Contract to Fluor

Visco Products Co., a unit of National Aluminate Corp. of Chicago, has awarded The Fluor Corp.'s Mid-Continent division at Houston a contract for the complete engineering, design, material purchasing and construction for an addition to its present facilities at Sugar Land, Tex.

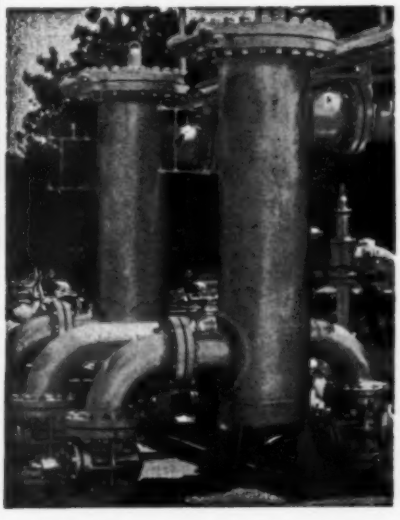
The plant addition will increase Visco's production of various oil-treating compounds, corrosion inhibitors, and chemicals for the oil-production and refining industries. Completion is scheduled for December 1957.

MOORLANE

GAS SCRUBBERS

AN ESSENTIAL ACCESSORY

FOR ALL GAS PIPE LINE SYSTEMS



Sizes available are 4-inch through 18-inch diameter vessels for any working pressure.

•

Capacity — up to 34,000,000 standard cubic feet per day.

•

Scrubber is dry type. No oil carry-over to worry about.

•

Filter medium is wool felt.

•

Removes all particles 5 microns (.0002") in size, and larger.

Efficiency remains constant from very low flows to extremely high volumes.

•

Low initial cost.

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Inexpensive to operate and maintain.

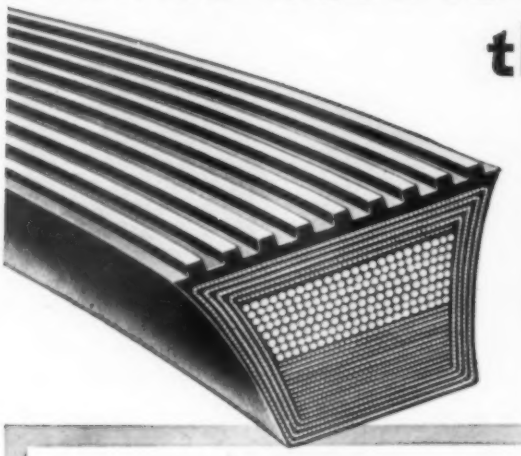
WRITE FOR YOUR COPY OF BULLETIN NO. 457 FOR DESCRIPTION AND PRICES

MOORLANE COMPANY

409 EAST ARCHER

TULSA 1, OKLAHOMA

Proved best for mud pump drives the world over...



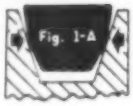
4 important engineering developments insure top performance from Rib-Top

1. Tougher, more resilient cords

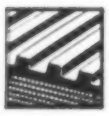
are able to absorb the severe pulsation of mud pumps; easily handle peak loads.

2. Concave Sidewalls (U.S. Pat. 1813698)

Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt... far longer belt life.

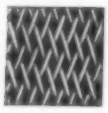


3. Stabilizing ribbed tops (U.S. Pat. No. 2548135)



— exclusive with Gates. Dampen vibration; protect top of belt; keep it running smoothly over idler-equipped mud pump drives without side whip.

4. Flex-Weave cover (U.S. Pat. No. 2519590)



provides greater flexibility with far less stress on fabric. Wears longer... lengthens belt life... lowers belt costs.

TPA-168

Used by more drillers on more mud pump drives than any other V-belt, Gates Rib-Top Vulco Rope is everywhere recognized as the outstanding performer in this tough service.

Rib-Top was developed *especially* for mud pump drives in the world's largest belt development center — at Gates — but costs no more than ordinary belts of comparable ratings. Available in Standard and Super at your oil field supply store.

Use Super Rib-Top for the tougher drives

With 40% greater horsepower capacity, Super Rib-Top easily handles drive overloads. Fewer belts and narrower sheaves solve space and weight problems.

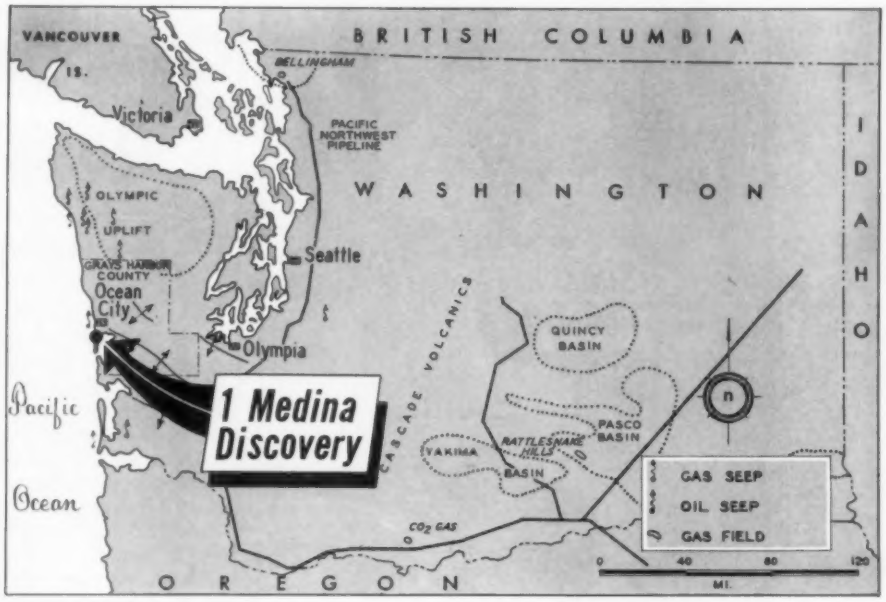
Gates — The Mark of Specialized Research

The Gates Rubber Co., Denver, Colorado

World's Largest Maker of V-Belts

Gates Rib-Top Vulco Rope

DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES



WASHINGTON'S first commercial oil strike is anticipated for the Ocean City area, Grays Harbor County. Sunshine Mining Co. et al 1 Medina flowed 223 bbl. daily on production tests last week. Fig. 1.

And then there were 32

Washington—New Oil-Producing State

By Frank J. Gardner
Exploration Editor

ONCE upon a time, there was a juvenile sheepherder named Jack. He got his kicks by crying out "Wolf, wolf!", and he'd roll in the grass and howl with laughter when his fellow citizens rushed out to help him. But one day Mr. Wolf really did swagger by and he made off with most of Jack's mutton, because by that time, nobody paid much heed to Juvenile Jack.

Now, wildcats and sheep are decidedly different breeds. But over the years, so many wildcatters in the State of Washington have cried "Oil, oil!" that when the real thing happened a month or so ago, nobody paid much heed. For a few days, that is. First reports of a 400-bbl. well at Sunshine Mining Co. et al 1 Medina met with a definite "show me" reception in most oil quarters.

Many disappointments . . . There was good reason for this skepticism. For through the years, hundreds of wells had been drilled in the state and many of them had reported oil and gas, but always in noncommercial quantities. Perhaps the greatest excitement has been generated since 1950, when major operators really began to take a good hard look at Washington. Continental Oil Co., Union Oil Co. of California, Standard Oil Co. of California, and Richfield Oil Corp. have all had a go at deep drilling there, in addition to dozens of independent operators.

But always the story has been the same—good initial showings or flows, followed by rapid dwindling to nothing. In 1950, Union's 1 State went to 6,278 ft. and found showings at about 4,000 ft. but was abandoned when the casing collapsed. Moving less than 100 ft. south, Union drilled the 3 State to 9,344 ft. and created much excitement when it tested oil at intervals between 3,670 and 6,400 ft.; small flows came from perforations at 3,670-4,440 ft. and 4,663-76 ft., but the well was finally given up because of sloughing shales. The well penetrated an unexpectedly thick Miocene section, however, and lent hope for future success. This seemed assured in 1951 when Hawksworth et al 4 State found three high-pressure gas sands in the top 126 ft. of the Miocene-Kincaid zone at 3,585 ft.; this one flowed up to 2,000 M.c.f. gas per day plus an estimated 35-100 bbl. of 47° oil, but it too was abandoned because of mechanical difficulties.

Plus rumors and speculations . . . So the Grays Harbor prospect gathered dust for several years. Four more failures were drilled on the structure. Then came the news of Sunshine's strike at the 1 Medina, less than a

DETAIL MAP of the Ocean City area. The 1 Medina sits below mean high tide on Washington's west coast. All wells shown here are situated on the same anticlinal uplift. Sunshine Mining Co. et al have staked 3 offsets to the discovery in a north-south line. Fig. 2.

half-mile north of the Hawksworth well. The news broke on July 17, when a 400-bbl. flow was estimated from a drill-stem test of the Nye-lower Miocene at 3,940-63 ft. Operators halted drilling at 4,135 ft., set 5½-in. casing, and tightened up on news from the wildcat.

Speculation and rumor flew thick and fast—was it or wasn't it? Sunshine promised to release testing dope on August 20. Meanwhile, some testing was done, and the usual influx of leasehounds began. Some companies were adamant, others were curious, and a few were wildly enthusiastic. Many West Coast operators were inclined to the "wait and see" opinion, fearing another cry of "wolf!" But by August 1, the state was caught up in the wildest rush for leases in its history; applications for half a million acres of state lands were filed. Privately owned land was selling at a fast clip. The State Land Commission hurriedly shook the dust off its rules and regulations book and decided it needed revising; meanwhile, the state sat firm on its lands, and Sunshine candidly staked three offsets (see Fig. 2).

When finally, on August 20, Sunshine opened up the well for the benefit of 1,000 observers, both political and petroliferous, it flowed at the rate of 223 bbl. per day from sand at 3,932-66 ft.; this was some better than earlier reports that it was good for 180 bbl. Sunshine officials maintained that if they "let 'er roar," the well was capable of 400 bbl. a day, but the restricted ½-in. choke flow was only sensible operating practice.

Testing will continue for the next few weeks to determine the true capacity of the well. But it appears now that at long last. Washington has entered the ranks as the thirty-second oil-producing state.

The Medina strike is the eighth wildcat to probe the large Ocean City anticline. The structure is 3½ miles long, trending NNW-SSE, and is cut by at least two faults, both upthrown to the west, which merge scissor-fashion at the south end of the uplift. Closure is about 500 ft. on the top of the Nye. The structure was found originally by Union Oil with seismograph and subsurface studies.

Precede a legitimate cry of "Oil!" . . . Grays Harbor County, then, finally is on production after 7 years of disappointment. The production performance of 1 Medina will be closely watched, but all signs point to a legitimate cry of "Oil!"

Geological Cambrian and Possibilities

By Allen M. Gutstadt

STRUCTURE contours drawn on top of the Trenton limestone (Middle Ordovician) show the Illinois and Michigan basins and the Cincinnati and Kankakee arches.[1] The fact that thickness trends of Cambrian and Ordovician formations are independent of these structural features indicates, however, that these features were not present during Cambrian and Ordovician deposition.

The results of a study of the oil possibilities of Cambrian and Ordovician rocks in the Illinois basin will appear in a future bulletin of the Indiana Geological Survey. This report summarizes some of the conclusions that will be presented in that bulletin.

Mt. Simon sandstone . . . The Precambrian basement in Indiana is overlain by the Mt. Simon sandstone, which is composed of medium to coarse, rounded and frosted quartz grains. The formation thins from more than 2,000 ft. northwest of the Jasper County test shown in Fig. 2 to less than 200 ft. in southeastern Indiana. Only 12 tests have penetrated the Mt. Simon in Indiana, and all have been located on the Cincinnati and Kankakee arches. Only six of these tests passed completely through the formation and reached the basement; shows consisting mostly of heavy oil and tar residues were reported in three tests.

The Mt. Simon is composed of highly permeable sandstone and would be an ideal oil reservoir. The Mt. Simon probably interfingers with dolomites, sands, and shales of the Eau Claire formation (Fig. 2). If so, permeability pinchouts may localize any oil present.

Eau Claire formation . . . The Eau Claire formation overlies the Mt. Simon sandstone and probably represents more seaward deposition in the same transgressing sea in which the Mt. Simon was deposited. Thus, parts of the Mt.

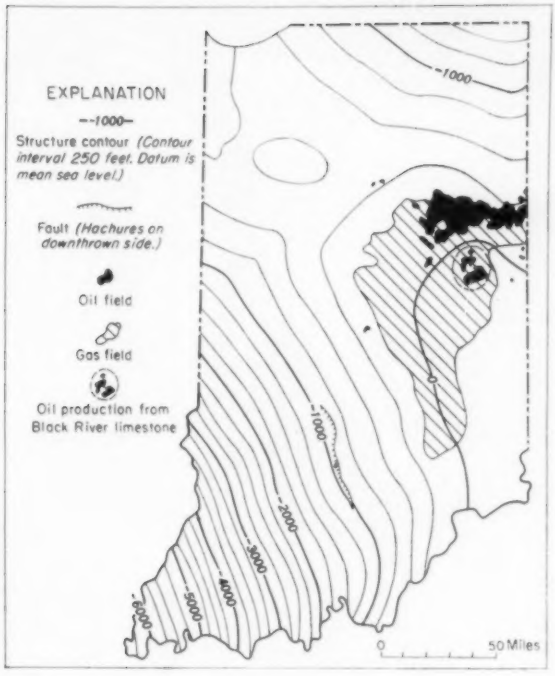
Author is with Creole Petroleum Corp., Lagunillas, Venezuela, and formerly was with the Indiana Geological Survey. Article published with permission of the state geologist, Indiana Department of Conservation, Geological Survey, Bloomington, Ind.

Study Shows Ordovician Oil for Indiana

In brief . . .

Here, briefly, are the oil and gas possibilities in Cambrian and Ordovician rocks in Indiana:

- Mt. Simon sandstone and Eau Claire formation. Apparently favorable reservoir lithologies, but insufficient information to evaluate.
- Knox (?) dolomite. Many shows, especially of gas; known to have permeability, but nature of permeability and quantity of gas not known.
- St. Peter sandstone. Excellent reservoir and pinchout along an unconformity, but no encouraging shows as yet.
- Black River limestone. Some production from localized permeable zones, but most of formation probably too tight to produce.
- Trenton limestone. Large production in old Trenton field. Best future possibilities in northern Indiana if closed structures can be found.
- Cincinnatian series and Maquoketa shale. Small amount of gas, apparently not in commercial quantities, but no favorable reservoir beds.



CONTOUR MAP (datum: Trenton limestone) shows the principal structural elements in Indiana. Notice that the production is largely confined to the Cincinnati arch. Fig. 1.

Simon and the Eau Claire are probably of the same age. The Eau Claire consists of dolomitic and glauconitic sandstone, siltstone, shale, and some dolomite. The formation is about 700 ft. thick in an east-west belt across north-central Indiana and thins to the north and south (Fig. 2), possibly because of transgressive relationships with both the Mt. Simon and the Knox (?).

Of 17 tests that reached the Eau Claire, 12 passed completely through the formation, and shows of gas, oil, tar, heavy oil, and dead oil were reported in 7. Little is known of the possible reservoir characteristics of the Eau Claire because of pronounced changes in its lithology. Much more drilling is needed before the potentialities of the formation can be evaluated.

Knox (?) dolomite . . . The Eau Claire is overlain by the Knox (?) dolomite, which is composed of cherty dolomite and thin sandstone lenses. The Knox (?) is equivalent to the Franconia sandstone, Tremealeau formation, and Prairie du Chien group of the upper Mississippi Valley, to the Upper Cambrian and Lower Ordovician dolomites and sandstones of Missouri, and to the Ellenburger, Arbuckle, and Knox Cambrian-Ordovician limestones. Exact correlation of the formation has not been established, however, and the name Knox (?), with a question mark, is used in Indiana.

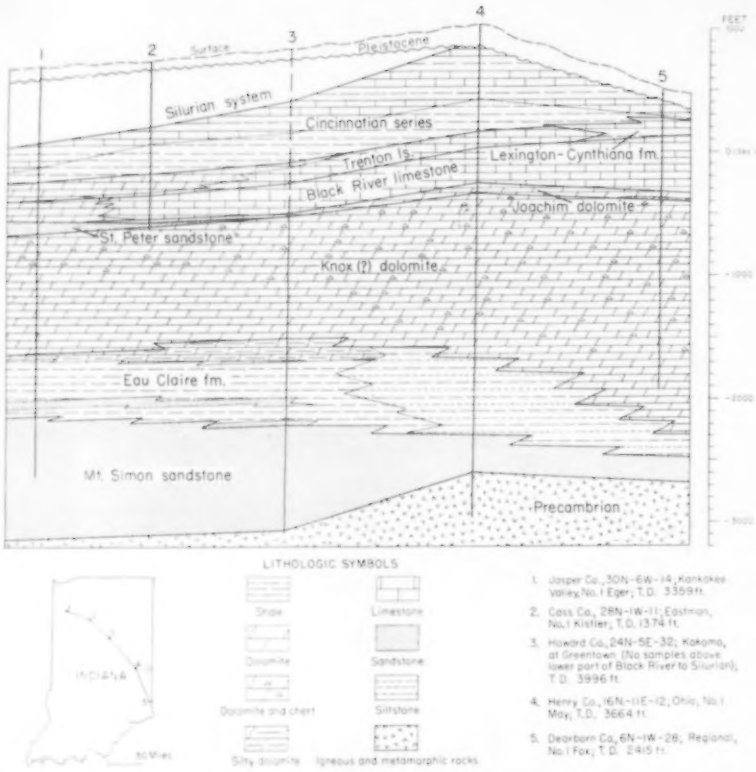
The Knox (?) dolomite ranges in thickness from more than 1,500 ft. in southern Indiana to less than 500 ft. in northern Indiana. This thinning is due, in part, to truncation beneath the overlying erosional unconformity upon which the St. Peter sandstone and its equivalents rest.

About 120 tests have been drilled into the Knox (?), but only 17 of these tests have passed completely through the formation. Shows of oil, gas, and tar have been reported in 26 of the tests. The formation is permeable, although irregularly so, and nearly all logs report water in amounts that have made cable-tool drilling difficult. The upper surface of the Knox (?) is erosional, and in most places the overlying Chazyan series appears to be as porous as the Knox (?) and could not serve as a seal. In northeastern Indiana, however, the Chazyan series is thin or absent and the overlying Black River limestone generally has low porosity. In this region some gas is evidently trapped just below the unconformity, but the records do not indicate how much gas is present.

St. Peter sandstone . . . The St. Peter sandstone, as a distinct lithologic unit, is confined to western Indiana, where it is composed of fine to medium-grained, rounded and frosted sand. The formation thins to the east and south from northwestern Indiana, where a thickness of 120 ft. has been recorded, and only local thin sandstone lenses which may represent the St. Peter occur in central and southern Indiana (Fig. 2). The formation is not present in the northeastern part of the state.

About 200 tests have been drilled to, or in search of, the St. Peter sandstone, but only seven of these have reported shows of oil or gas. This sandstone has been thought by many to be the most attractive sub-Trenton formation for oil and gas exploration because it is composed of a uniform permeable sand which pinches out in places beneath an impermeable limestone (Black River). The apparent scarcity of oil and gas in the St. Peter may be due to flushing, as the St. Peter contains fresh water in places. However, in southern Indiana it contains salt water. A suitable source of hydrocarbons may not have been available to what could be an excellent oil reservoir.

Black River limestone . . . In most of Indiana the Black River is composed of light and dark lithographic limestone with some metabentonite zones near the top. In northwestern Indiana, however, the entire formation is com-



THERE IS 3,500 ft. of sediments in Indiana with several potential pay zones. Strat-trap possibilities are excellent because of the facies changes. Fig. 2.

posed of dolomite, which is the continuation of the Platteville dolomite exposed in Illinois. The formation thickens from about 200 ft. in northern Indiana to about 600 ft. in southern indiana (Fig. 2).

Approximately 500 tests have been drilled into the Black River in Indiana, and many shows have been reported. Some commercial oil has been found in east-central Indiana, but the amount of oil is small compared with that from the overlying Trenton limestone. Except in northwestern Indiana, most of the Black River is too impermeable to serve as a reservoir. The shows reported probably have been related to locally dolomitized parts of the formation or to fracture zones.

Trenton limestone . . . The Trenton consists of finely to medium crystalline limestone or dolomite throughout most of Indiana. The formation consists entirely of dolomite in northwestern Indiana, where it is continuous with the Galena dolomite of Illinois. This dolomite facies of the Trenton thins to the south and to the east. The formation as a whole thins from more than 200 ft. in northern Indiana to less than 50 ft. in southern Indiana. Thinning of the Trenton in southern Indiana is accompanied by a reciprocal increase in thickness of the overlying Eden shale, the basal unit of the Cincinnatian series. In the extreme southeastern part of Indiana the position of the Trenton is occupied by interbedded limestone and shale that are probably the subsurface equivalent of the Lexington and Cynthiana limestones exposed in central Kentucky.

Although production of oil and gas from old Trenton (or Lima-Indiana) field (Fig. 1) has been negligible for the past 40 years, the Indiana portion of the field has produced a total of about 110 million barrels of oil.

Entrapment of oil and gas in Trenton field seems to be largely a function of differences in permeability. Oil is found mostly in the upper dolomitized parts of the formation; gas occurs more extensively and at the same structural position as the oil, but in limestone of low permeability. These facts suggest that the gas migrated more readily than the oil into the less permeable parts of the formation. Throughout the field, the Trenton is overlain by shale. As in all facies traps, the oil has migrated updip. The position of the field on the flank of the Cincinnati arch is the controlling structural feature.

The dolomite facies of the Trenton limestone thickens to the north and west in Indiana and retains the lithologic character found in the old field. The overlying shale seems to contain less carbonaceous matter to the west of the field, but the significance of this difference is not known. Favorable reservoir conditions exist throughout northern Indiana, and although stratigraphic traps similar to those that account for production in the old Trenton field seem improbable, any closed structure should be worth testing. Some Trenton oil has been found in south-central Indiana (Fig. 1), but this oil seems to be in local fracture zones associated with faulting.

Cincinnatian series and Maquoketa shale . . . The Cincinnatian series in outcrop in southeastern Indiana is divided into the following units, in ascending order: Eden shale, Maysville group (limestone and shale), and Richmond group (limestone and shale). In western Indiana equivalent rocks are assigned to the Maquoketa formation, which is composed of upper and lower shales separated by limestone or dolomite. The Cincinnatian thins from about 800 ft. near outcrop to about 300 ft. near the west boundary of Indiana (Fig. 2).

The Cincinnatian contains minor amounts of gas in southeastern Indiana, but very few shows have been reported elsewhere in the state in the Cincinnatian series and Maquoketa formation. Neither appears to be a likely prospect for oil and gas because of the lack of good reservoir rocks.

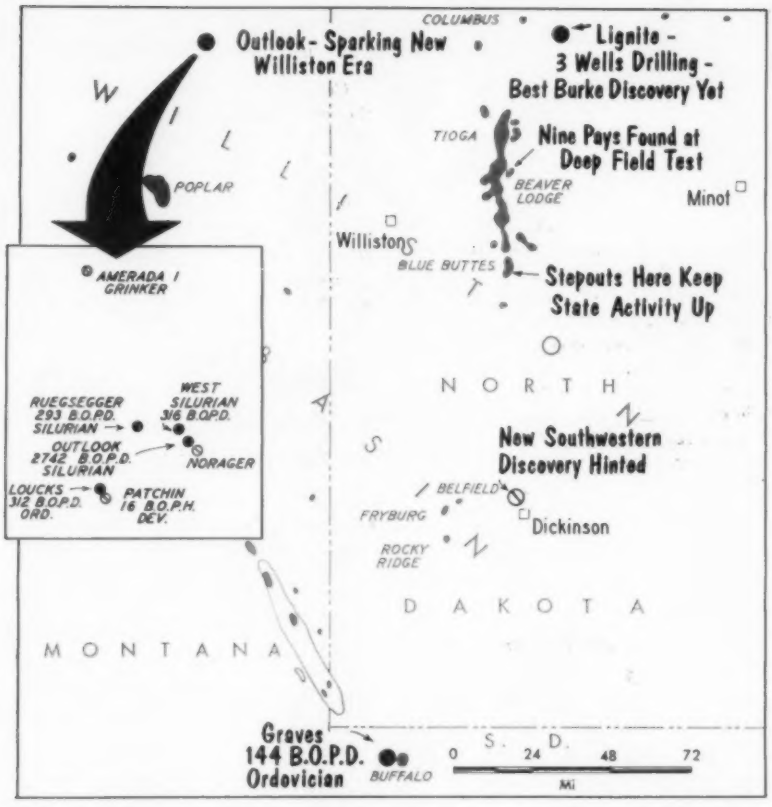
Exploratory and development drilling in Indiana are running a bit short of 1956 figures. Total wildcats drilled thus far this year . . . 78 (88 last year). Total wells drilled this year . . . 388 (412 last year). There are six new oil fields in the state this year.

Reference

1. The Tectonic Map Committee of the American Association of Petroleum Geologists, meeting in St. Louis on March 31, 1957, agreed that the term Kankakee arch, as used on the forthcoming revised edition of the Tectonic map of the United States, would be restricted to a small, separate positive feature that lies in northwestern Indiana (parts of Jasper, Pulaski, White, and Cass counties). The name is so used in this report.

EXPLORATION THIS WEEK

Appalachian	220
California	220
Canada	223
Illinois Basin	224
Kansas	227
Louisiana	227
Michigan	228
Oklahoma	228
Rocky Mountains	229
Tennessee	230
Texas	232
Successful Wildcats	243



STIRRED by discoveries in all three Williston states the basin is making a big rebound back onto the Rocky Mountain success scene.

Wildcat Fever Breaks Out Over Wide Williston Area

Outlook discovery triggered renewed exploratory activity

By John C. McCaslin
District Editor

THE YEAR 1957 appears to be "comeback time" for the Williston basin. Important oil discoveries in Montana, North Dakota, and South Dakota are reviving lagging exploration in this scarcely tapped basin. The wildcat drill is tapping new and deeper pay zones throughout the basin this year, unfolding the first pages of a new oil era in Williston.

Outlook . . . The well that started this new Williston wildcat fever was Amerada Petroleum Corp.'s 1 Tange in Sheridan County, northeastern Montana. As if to presage what was to follow, the discovery was named Outlook.

In Montana

. . . Tange flowed 2,742 bbl. of oil per day on ½-in. choke from Silurian rocks.

. . . The strike opened first production in Sheridan County.

. . . It is the best potential yet anywhere in the basin.

. . . Silurian success at Outlook revealed some almost forgotten potentialities of this Williston basin section, even though oil flowed from these rocks in the basin's birth well at Beaver Lodge.

. . . Outlook blossomed out and now boasts four producers, one dry hole, one apparent producer, and two drilling.

After the Outlook discovery last winter Amerada followed closely with success at Ruegsegger and Loucks. The Ruegsegger well flowed 293 bbl. of oil per day from the Silurian; the Loucks well 312 bbl. per day from Red River-Ordovician. Both wells are far enough away from Outlook to be called new fields. Outlook itself was recently confirmed at 1 West for 316 bbl. per day from Silurian. Another well is drilling nearby at 1 Norager. The Loucks well apparently has a confirmation also at 1 Patchin. This one flowed 16 bbl. of oil per hour on tests in the Devonian Winnipegosis. Winnepegosis production would be a new chapter in Williston pay-zone history. Other Devonian production in the basin is from Three Forks.

The outlook for northeastern Montana's contribution to the Williston revival is excellent. Successful completion of confirmations at Loucks and Ruegsegger plus additional development at Outlook itself may very well pull Williston way out of the fire. The real importance of the Outlook discoveries is that a pre-Mississippian play is building up in both Montana and North Dakota . . . a story told so many times in older producing provinces—the story of looking for new and deeper pays in established areas.

In North Dakota

Deep and rank . . . The North Dakota side of Williston's new look is one of ultradeep drilling, rapid development of older fields, new interest off the Nesson anticline, and a peek into sparsely scrutinized wildcat sections of the state.

. . . Beaver Lodge. Two deep holes in North Dakota's first producing area have come up with some highly interesting data for future drilling under shallower production in the Nesson anticline.

Amerada's 1 Iverson-Nelson unit on the southwest end of the field in Williams County uncovered nine pay zones on its way down to 13,615 ft., total depth. This is what lies under the spectacular Beaver Lodge field: Two Winnipeg-Ordovician sands which made 8,000 M.c.f. of gas per day with some oil; a Red River-Ordovician sand that yielded 9,000 M.c.f. of gas per day plus 400 bbl. of oil; the Interlake-Silurian A zone which flowed 147 bbl. of oil per day, 68 bbl. of water, and 2,000 M.c.f. of gas; the Interlake B zone with 150 bbl. of oil; the Interlake C zone with 140 bbl. of oil; the Interlake D zone with 346 bbl. of oil and

3,400 M.c.f. of gas; the Duperow Devonian zone with 340 bbl. of oil per day. Additional pay is present in the field zone, the Mississippian-Madison. Still to be tested in the well is more Duperow and possibly the Nisku-Devonian.

Two other wells at Beaver Lodge are probing the very depths of the Williston basin. One of them set a basin and state drilling-depth record at 14,828 ft. It is the 9-A Unit. The other is drilling at 13,931 ft. (the 1 Boe Olson Unit).

Rank discovery prospect . . . The exploratory year in North Dakota began early with a tremendously successful wildcat discovery in Billings County at Rocky Ridge. This Heath strike in southwestern North Dakota's Fryburg and Belfield area flowed up to 1,400 bbl. of oil per day from the Heath sand, the best such strike yet in the basin. But the follow-up well was dry and the drilling heat subsided for awhile. A couple of weeks ago Leach Oil Co. got back on the track in this area with an indicated Mississippian-Nesson pay discovery in Stark County near the town of Dickinson. This rank wildcat, if successful, will confirm the beliefs of many that this section of the Williston basin conceals many oil reservoirs. Leach's wildcat will make or break exploration in this part of the state this year.

Mississippian remains king . . . Despite the onslaught of new deep discoveries and impending production from rocks below the Madison, the Mississippian section of the Williston basin is still going strong.

. . . Blue Buttes. A brisk stepout program is under way in this southern Nesson anticline field with excellent success reported. Completions here have kept North Dakota drilling activity above the previous year.

. . . Lignite. Off-Nesson anticline exploration continues popular in North Dakota. The best Burke County discovery yet was recently completed by Northwest Oil Drilling Co. 10 miles southeast of Columbus field. The well made 225 bbl. of oil per day for a record gage in this area. Pay is the Midale-Mississippian. The confirmation well flowed 234 bbl. per day with tests continuing. Phillips Petroleum Co. is drilling in the immediate area and Pan American Petroleum Corp. has staked location. Burke County itself is one of the most active counties in North Dakota with a dozen additional active locations and tests.

In South Dakota

Oil field No. 3 . . . Shell Oil Co. has given South Dakota its third distinct producing area about 1 mile west of the initial producer in the state at Buffalo in Harding County. The 32-17 Graves pumped 144 bbl. of oil and 59 bbl. of water per day from Red River-Ordovician. This well is the third in the Buffalo area. The state's other producing area is in the southwest on the east fringe of the northern Powder River basin. **End.**

Rank Wildcat Completed Dry in East Whitefield

Columbian Carbon Co. gave up after the second fracturing job at its East Whitfield Township wildcat, the 1-1839 Sam Hutchinson in Indiana County, southwestern Pennsylvania.

The rank wildcat found the Tully at 7,356 ft., the Onondaga at 8,107 ft., the chert at 8,144 ft., gas sand (Oriskany) at 8,355 ft. Total depth was 8,388 ft.

EXPLORATION HIGHLIGHTS

APPALACHIAN

OHIO

One of Best Wells Finaled at Walhonding

Oxford Oil Co. has completed one of the best initial producers in the Walhonding River Valley. Their 1 (2) M. W. C. District, Lot 3, 2nd Qr., New Castle Township, Coshocton County, logged the Clinton at 2,909-60 ft. with 4 bbl. natural and an estimated 800 bbl. for the first 24-hour period.

The well is the first and east offset to Bell & Ridgeway 1 M. W. C. D., a ⅔-mile west extension to Walhoning pool.

Rank Gas Discovery Found in Meigs County

A shallow gas pool has been found nearly 4 miles west of production in Salem Township, Meigs County. Winrad Gas Co. 2 J. E. Cobb, Section 26, confirming the pool, gaged 1,400,000 cu. ft. natural from the Maxon sand topped at 656 ft. and drilled in to 658 ft.

PENNSYLVANIA

Two Wildcats Completed As Gas Discoveries

In Young Township, Indiana County, New York State Natural Gas Corp. completed its N-2-543 Florence Boden for 2,421 M.c.f. of gas per day in the Oriskany sand at 7,470-98 ft. Rock pressure was 2,485 psi.

In Armstrong Township, Indiana County, T. W. Phillips Gas & Oil Co. completed the 2 A. W. Robinson for 500 M.c.f. of gas per day at 7,550-72 ft. No fracture job was necessary.

CALIFORNIA

Richfield Scores Again At Wheeler Ridge

Richfield Oil Corp. chalked up an important successful extension of the Wheeler Ridge Community pool with completion of 81-36 KCL F. This test is located about ½-mile south of the Community pool discovery well. It came flowing at a rate of 221 bbl. daily of 37.9°-gravity crude. The perforated zone is 7,695-7,762 ft. Total depth is 9,718 ft., plugged back to 7,770 ft.

Texaco Gets Another Top Honor Rancho Well

The southwest area of Honor Rancho field in northern Los Angeles County continues to turn up top producers. The Texas Co., which has been alternating with Superior Oil Co. in bringing in excellent wells in this activity, was the latest to score with a well about ¼-mile west of the nearest other producer.

Texaco completed 3 Newhall flowing 810 bbl. daily of 33.6°-gravity crude through a 20/64-in. choke from a zone at 10,105-10,518 ft Total depth is 10,562 ft

Intex Hits Shallow Field

Intex Oil Co. hit a shallow field discovery in NW NW 31-5n-16w, which is in the Charlie Canyon area of north Los Angeles County. The well, 2 Yule, was completed on the pump for 139 bbl. daily, 13 per cent cut, of 17.8°-gravity crude from a sand at 1,009-1,141 ft.

Union's Second Houchin Well Is Big Producer

Union Oil Co.'s first extension test of its recent Houchin pool discovery in the Mountain View field, Kern County, proved to be larger than the discovery well. The new well, 53-27 Union-Hancock-Houchin-Guimarra, flowed 701

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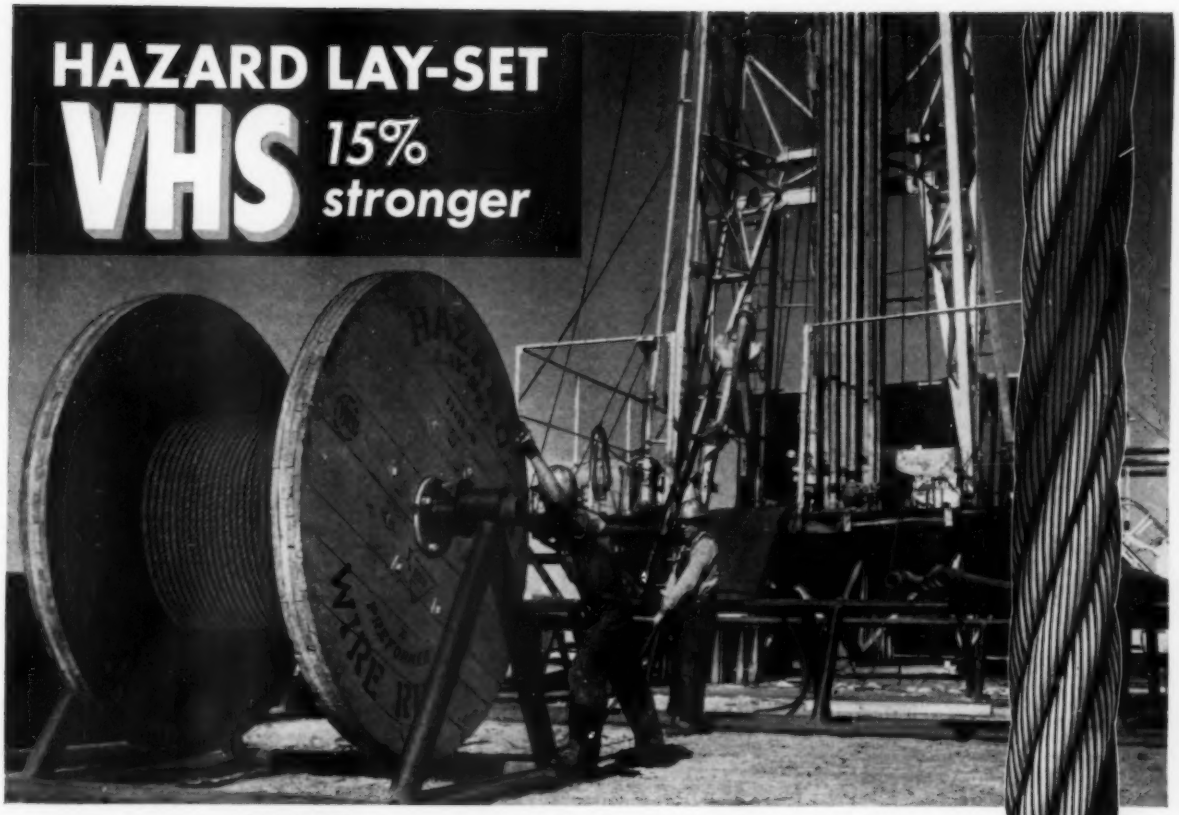

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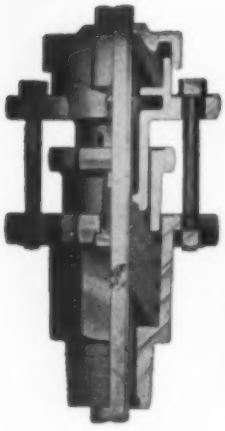

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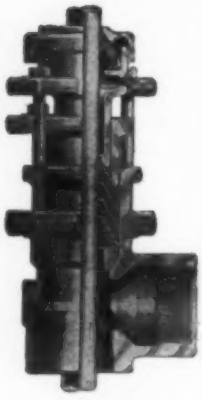

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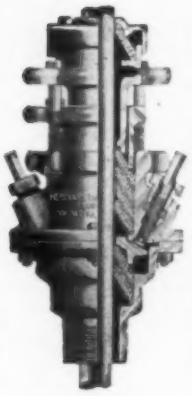

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bbl. daily of 34.2°-gravity crude from an interval at 8,125-8,255 ft. Flow was through a 24/64-in. choke. It is located about ½-mile north of the discovery well in 27-31s-29e. It is also about 1½-miles west of the town of Arvin.

Ajax Plans Santa Cruz Test

Ajax Oil & Development Co. announced plans to drill an 1,800 ft. Butano sand test in SW NW 36-7s-3w, in northern Santa Cruz County. Spud date is tentatively set for early next month. The drill site is just off State Highway 5 on a 500 acre lease held by Ajax. Nearest production is at Union Oil Co.'s Oil Creek field 3 miles to the south. This general area first produced oil in 1886.

CANADA

ALBERTA

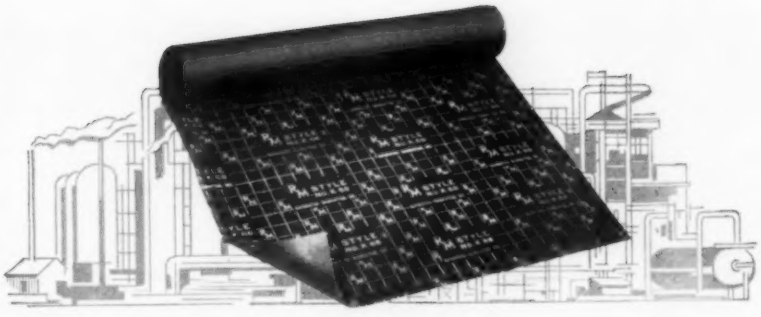
Mississippian Gas Tapped at Crossfield

Two wells in Alberta, one in the southern sector and the other in the central-west portion highlighted western Canada's exploratory activity during the past week. The most significant perhaps was Tennessee Gas Transmission's wildcat test in the Crossfield area of southern Alberta which obtained a gas flow rate of 8,000,000 cu. ft. daily along with a heavy spray of condensate from the Mississippian-Elkton formation. The central-west venture lies in the Whitecourt area and was drilled by the team of Canadian Fina Oil, Ltd., Pan American Petroleum Corp. and Hudson's Bay Oil & Gas Co., Ltd. That venture flowed oil from D3 formation in an area better known for its Devonian wet-gas qualities and Viking and Mississippian oil-bearing structures.

Tennessee's new find 1-20-28-2, is being drilled on LSD 1, 20-28-2w5. It lies 21 miles north of Calgary's city limits 1¼ miles northeast of the Shell C10-18 Crossfield wildcat abandonment and is 3½ miles northwest of the Shell A13-2 Crossfield Cardium sand oil discovery well.

Strike was indicated at the hole during initial drill-stem test in the Mississippian-Elkton horizon when a 20-ft. interval below 8,545 ft. was evaluated. The gas flow rate of 8,000,000 cu. ft. daily was accompanied by a heavy spray of condensate and when pipe was pulled it was found to contain 50 ft. of that light gravity oil along with 370 ft. of gas-cut mud. Coring and testing operations on the hole are being continued.

The venture is being drilled on Drilling Reservation right purchased from the Alberta Government and if the



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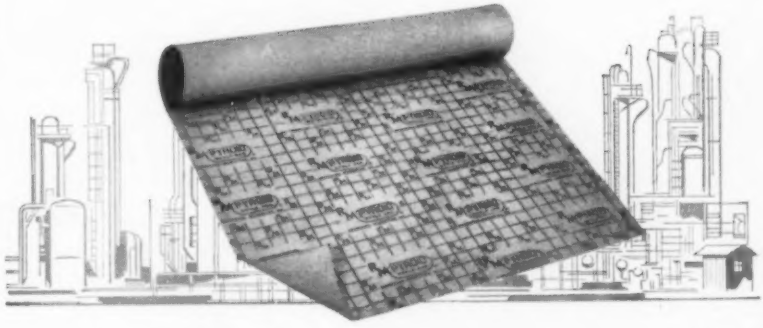

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hoped-for oil column is present below the gas-cap the company has the right to select 12 quarter sections out of the reservation under Petroleum and Natural Gas Lease. However, if the well is completed as a gas well the whole tract of 8,960 acres may be converted to gas license.

The major development team in the Whitecourt area, Canadian Fina, Pan American and Hudson's Bay, announced that another well in its program has indicated discovery. This time an oil column in the D3 zone of Devonian. The gas bearing reef in the area has been followed-up with great success in this particular area and the new oil find was registered at the 7-8 Windfall test, on LSD 7, 8-60-15w5, which lies 1 mile due north of the group's 7-5 Windfall D3 wet-gas success that also discovered oil in the Viking and Mississippian horizons.

This prolific oil and gas area is approximately 35 miles southeast of the Phillips 1 Kaybob Beaverhill Lake-Middle Devonian oil strike and is the same approximate distance southwest of the Home et al 9-20 Virginia Hills oil discovery hole.

As well as flowing oil at the rate of 20 bbl. hourly the well also contained good gas-bearing qualities as gas flow rates up to 15,000,000 cu. ft. daily were recovered during earlier drill-stem tests in the formation.

SASKATCHEWAN

Province's Second Bakken Field Opened

Saskatchewan's lone discovery, meanwhile, was drilled by an independent oil operator on farmout lands from Tidewater Oil Co. It lies in the central-east sector, near Rocanville townsite and indicated an oil bearing zone in the Bakken portion of the Mississippian structure.

The central-east Saskatchewan discovery was chalked up at the Riddle-Tidewater 16-32 Rocanville venuture, drilled on LSD 16, 32-15-31w1. That test lies 12 miles northeast of Wapella townsite and 10 miles west of the Saskatchewan-Manitoba border. The Bakken, or lower portion of the Mississippian in which the operator recovered some oil, oil-cut mud, and oil-mud emulsion, during drill-stem test operations is only productive in one other area of Saskatchewan and that lies in the Roncott area, some 250 miles southwest of the new find.

Production casing has been run on the well, which was carried on down to the test the Precambrian in the area and has since been shut-in pending further evaluation work.

ILLINOIS BASIN

INDIANA

New Area Rapidly Develops North of Mount Vernon

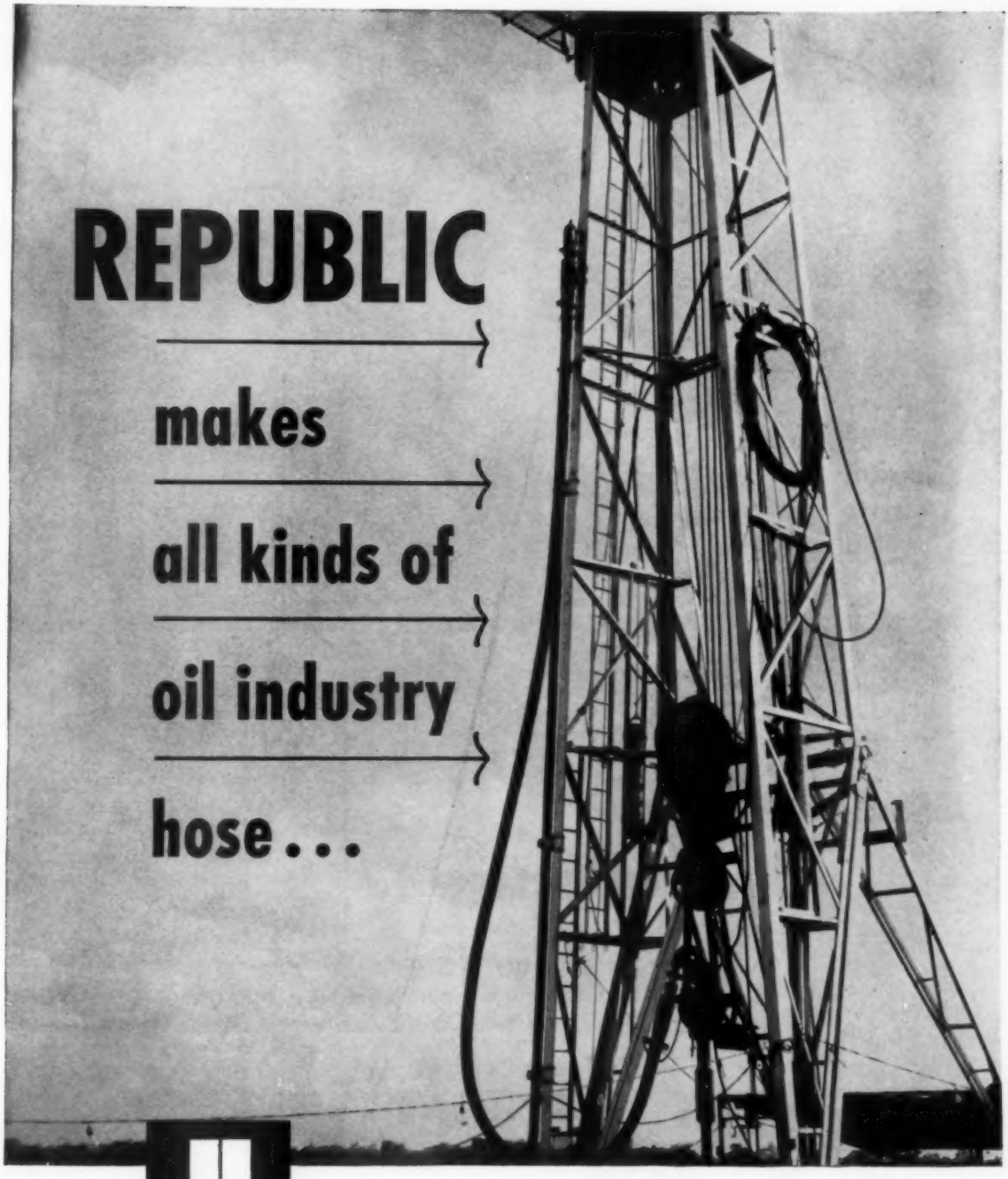
A new producting area north of the city of Mount Vernon in Posey County is helping to bring Indiana back onto the Illinois basin oil scene. Some wells have had potentials up to 400 bbl. per day from the Palestine sand of Mississippian age. Operators are V. R. Gallagher and Indiana Farm Bureau.

Generalized Stratigraphic Table

AGE	NORTHERN CALIFORNIA	SAN JOAQUIN VALLEY REGION		COASTAL REGION			LOS ANGELES BASIN
		WEST SIDE & CENTRAL	EAST SIDE	SANTA MARIA BASIN	SANTA BARBARA COASTAL BASIN	VENTURA BASIN	
PLEISTOCENE	Red Bluff	Tulare	Tulare	Paso Robles	Santa Barbara	Saugus	San Pedro
UPPER PLIOCENE	Tehama G	San Joaquin Clay	Kern River	Careaga Foxen	Pico	Pico	Pico
LOWER PLIOCENE		Etchegoin G Jacalitos	Etchegoin	Sisquoc	Repetto	Repetto	Repetto
UPPER MIOCENE	San Pablo Series	Reef Ridge McLure McDonald	Chanac Sta. Margarita Fruitvale	Monterey	Monterey	Modelo	Puente
MIDDLE MIOCENE		Devilwater Gould Button Bed	Up. Round Mtn. Mid. Round Mtn. McVan	Temblor	Rincon	Topanga	Topanga
LOWER MIOCENE		Media Carneros Santos Phacoides Vaqueros	Low. Round Mtn. Olcese Jewett Vedder Walker		Vaqueros	Vaqueros	Vaqueros
OLIGOCENE		Tumey Leda Oceanic	? Kreyenhagen	Lospe	Sespe	Sespe	Sespe
EOCENE	Markley Domengine G Capay G Meganos G	Point of Rocks Avenal Domengine Gatchell	Domengine Famoso		Coldwater Cozy Dell Matilija	Llajas Santa Susana	Tejon
PALEOCENE	Martinez G	Martinez			Martinez	Martinez	Martinez
CRETACEOUS	Chico G Shasta	Moreno Panoche G			Chico	Chico	Chico
JURASSIC & OLDER	Knoxville Granite	Franciscan	Schist Granite	Knoxville-Franciscan	Knoxville-Franciscan	Schist Granite	Schist Granite

■ OIL PRODUCING FORMATIONS
G GAS PRODUCING FORMATIONS

THIS TABLE is from Annual Review of California Crude Oil Production published by Conservation Committee of California Oil Producers, 471 South Hill Street, Los Angeles 13, Calif. This catalog-size report is divided into historical, conservation, and geological sections. Complete tables and drawings are included plus other statistical data. The committee also has published a report titled, "Discoveries of New Fields and Pools," which is a supplement to the annual review.



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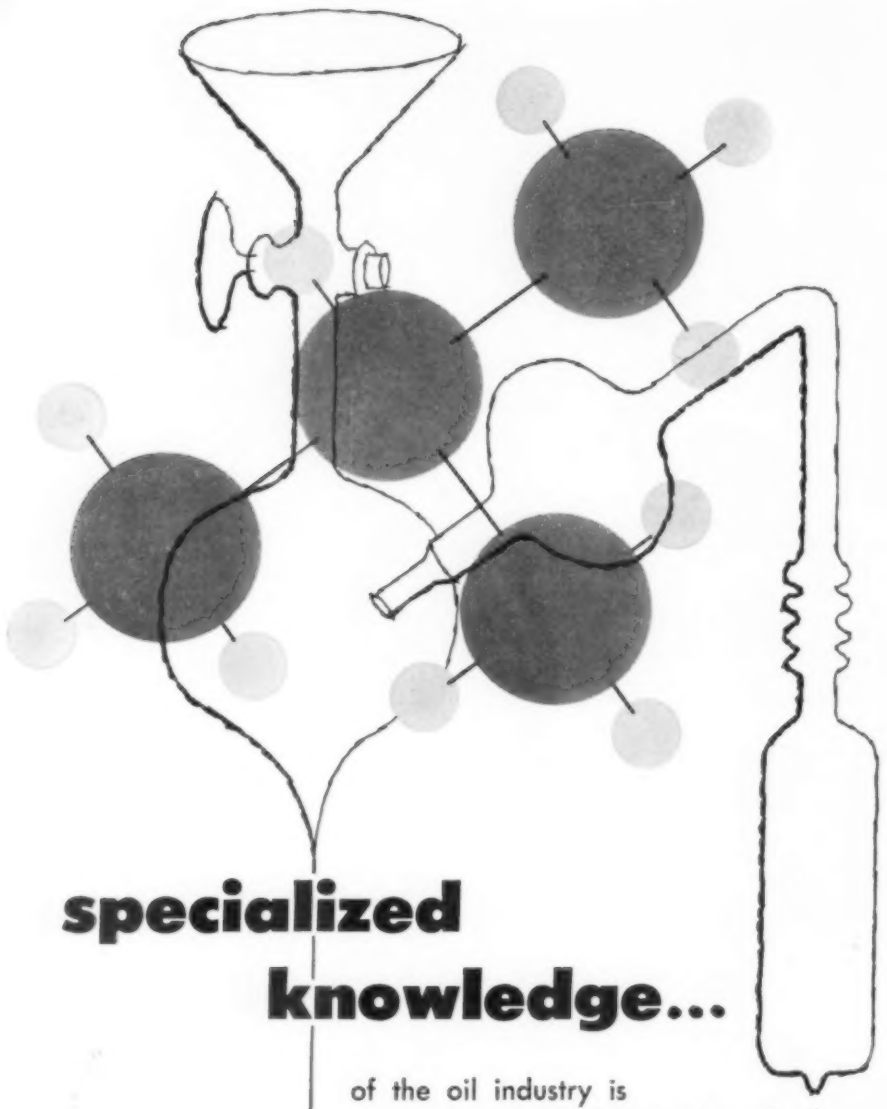

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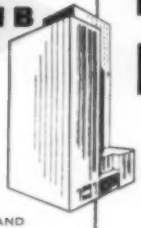

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KANSAS

Kansas Geological Society Field Trip Announced

The Kansas Geological Society will conduct its Twenty-first Annual Field Conference, a 3-day trip in eastern Kansas on Thursday September 19-Saturday, September 21. The conference will be led by Dr. J. M. Jewett with the cooperation of the Kansas Geological Survey, headed by Dr. Frank Foley.

The subject of the conference will be part of the lower Permian, but particularly the Pennsylvanian system as it is exposed in eastern Kansas. Units of the Pennsylvanian system are well exposed in this area.

The guidebook will contain maps and a detailed road log of the caravan route. It will be illustrated with maps, columnar sections, and regional correlation tables. In addition, it will contain a number of excellent papers on different aspects of the geology of the area.

Advance registration should be accompanied by a deposit of $5 before September 15. Contact Tom Bush, chairman of the Field Trip Committee, Kansas Geological Society, 508 East Murdock, Wichita. Phone AMhurst 5-8677.

LOUISIANA

LOUISIANA OFFSHORE

East Cameron Block 126 Wildcat Is Discovery

A gas condensate discovery, 33 miles offshore from Louisiana in the Gulf of Mexico and 5 miles from the nearest production, has been reported by Pure Oil Co., operator for two groups of companies.

The well was drilled on the flank of a salt dome in Block 126 in the East Cameron area. On a drill-stem test, the well had an indicated production rate of 10,000 M.c.f. of gas a day along with condensate at the rate of 55 bbl. per million cubic feet. The condensate tested 50.5°-gravity. Tubing pressure was 3,565 psi.

Production was through perforations in the bottom 10 ft. of sands from 8,133 to 8,176 ft.

The discovery is on a 240-acre drilling unit, a joint project of a group composed of the Pure, Sun, Ohio, and Seaboard oil companies and the C.A.T.C. group (Cotinental, Atlantic, Tidewater, and Cities Service) Each group has separate leases on 2,500 acres in Block 126

The well, drilled from a platform in 70 ft. of water, has been shut in pend-

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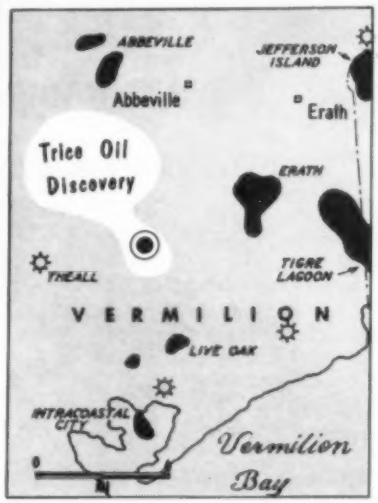
ing installation of a gas line to shore. It is 22 miles south of Pure's Rollover gas field.

SOUTH LOUISIANA



LOCATION of Trice Oil Co.'s new oil and gas discovery well in southeastern Vermilion Parish.

Deep Discovery Opens New Vermilion Field

Trice Production Co., Longview, Tex., reports a new oil and gas discovery in southern Vermilion Parish, Louisiana. Location is about 3 miles southwest of the large multiple-pay Erath field, and about the same distance east of the Theall area, where Pano Tech Exploration Co. has two gas-condensate wells.

Trice's discovery well, 1 Wise, in 62-13s-3e, is productive from perforated interval at 10,617-23 ft. after being drilled to 10,940 ft. Flow rates during a 5-hour test through 5/32-in. choke was estimated at 150 bbl. of high-gravity oil and 400,000 cu. ft. of gas per day. Flow was under pressure of 1,225 psi.

The well is a joint operation with Christie, Mitchell & Mitchell, of Houston. Atlas Drilling Co., contractor, spudded May 14.

MICHIGAN

Shallow Gas Field Indicated in Isabella County

A new shallow sand gas field was indicated with Clem Glavin's 1 Clabuesch, SE NE SE 7-14n-5w, Deerfield Township, Isabella County, showing estimated 1,150,000 cu. ft. at 1,321 to 1,326 ft.

Located 1 mile northeast of the closest production in the old Deerfield-Broomfield gas pool, Glavin's wildcat appeared sure to open a new play. Michigan Stray sand was logged at 1,318 ft. with 100,000 cu. ft. of gas at 1,321 ft and an increase in excess of 1,000,000 cu. ft. at 1,323 to 1,326 ft. where drilling was halted for orders.

Outpost originally was intended for a 3,700 ft. test of the Dundee lime for oil. The wildcat is 3 miles southeast of the Sherman oil field.

Michigan Consolidated Gas Co. started preliminary work several months ago in acquiring gas storage rights for the entire Broomfield-Deerfield area.

Merrill Drilling Co. is affiliated with Glavin in the current exploratory development.

OKLAHOMA

NORTHWEST

Extension Indicated at Northeast Catesby Pool

A new Morrow gas pool in Ellis County, Northeast Catesby, appears headed for confirmation at Shell Oil Co. 1 Ohern, C NE SW 32-24n-25w.

The well flowed 2,820 M.c.f. of gas per day plus 1 bbl. of condensate on test of perforations at 8,194-8,226 ft. Other perforations are being readied for tests.

This field, which reopened produc-

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tion in Ellis County, was opened recently at 1 Peetoom in NE NE SW 29-24n-25w. This Morrow producer flowed 1,018 M.c.f. of gas per day on 1-in. choke.

Good Well Added to Southeast Stockholm

The booming Southeast Stockholm field in Harper County, one of the fastest-growing new Pennsylvanian reservoirs on the northeastern shelf of the Anadarko basin, added a 30-bbl. per hour well, natural, at Eason Oil Co. and Wilcox Oil Co. et al 2 Earl Campbell in C SW SW 21-26n-23w.

The flow was on ½-in. choke from perforations in the lower Tonkawa at 5,510-15 ft.

WESTERN

Atoka Discovery Finaled By Shell in Beckham

A wildcat southwest of famous Elk City field in Beckham County is an Atoka - basal Pennsylvanian discovery. Shell Oil Co. 1 Boyd, C NW NW 15-9n-22w, flowed 21,000 M.c.f. of gas per day on 5-point potential test. Perforations in this deep Pennsylvanian sand were at 10,114-74 ft. and open hole at 10,212-65 ft.

SOUTHWEST

Kiowa County Simpson Discovery Completed

Carter Oil Co. cemented its important Simpson discovery northwest of Carnegie field in Kiowa County. The 1 McDonald, NW SE SE 16-7n-14w, flowed open flow 6,220 M.c.f. per day, calculated, from perforations at 3,330-85 ft.

SOUTH-CENTRAL

Fourth Pay Added to Impressive McClain Hit

One of the most important discoveries of the year in south-central Oklahoma appears to be Cooperative Refinery Association's 1 Walker "B" in NE NW 18-7n-2w. Production is indicated from four Ordovician zones, the Tulip Creek, the first and second Bromide sand, and most recently from the McLish.

A test in the McLish at 8,898-8,906 ft. recovered 630 ft. of oil. This discovery is another addition to the growing checkerboard of discoveries in the Ordovician sands in this section of Oklahoma. The strike is on a seismic prospect and should cover 320 acres. The Ordovician sands of southern and south-central Oklahoma are proving to be prolific sources of new oil in the state's vigorous search for reserves.

ROCKY MOUNTAINS

COLORADO

Prolific Flow Reported At Weld County Discovery

A discovery in the Denver basin flowed 1,128 bbl. per day on 36/64-in. choke from "D" sand perforations at 6,942-43, 6,745-48, and 6,949-57 ft. The new field opener is Shell Oil Co. 1 State-1134, C NW SE 16-11n-58w, Weld County, 6 miles south of Sisson field production (Kimball County, Nebraska). Nearest Colorado production is 9 miles east.

The Shell discovery is in rank Denver basin wildcat country. Tests are continuing at the well which also had oil shows in the "J" sand. Nearest previous drilling to the well is 2 miles.

WYOMING

Dead Horse Creek Field Continues to Expand

The most active new area in the expanding central Powder River basin play is Dead Horse Creek field, a recent Parkman-Mesaverde Cretaceous

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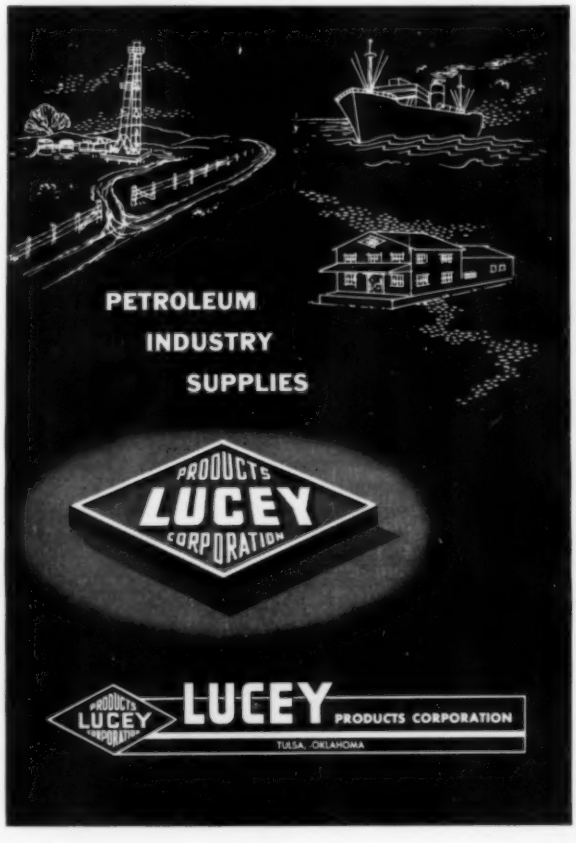

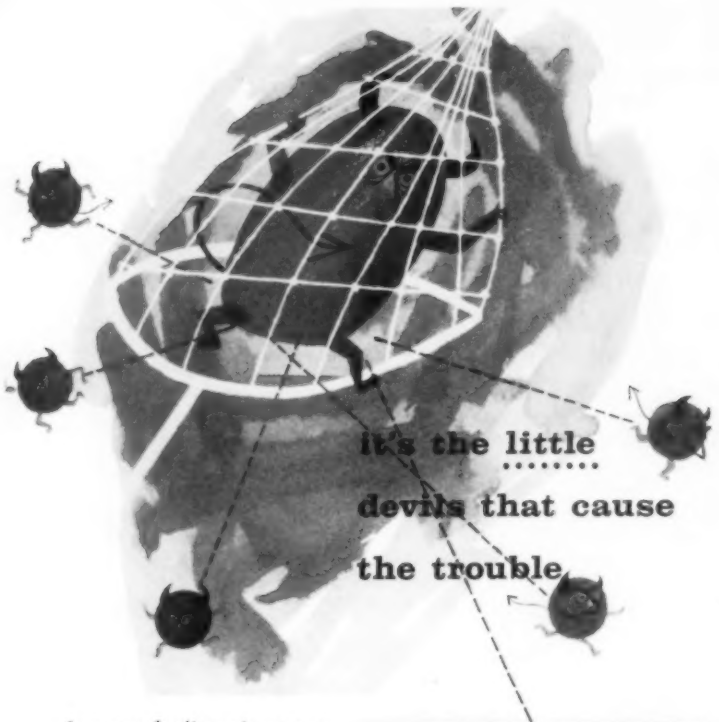

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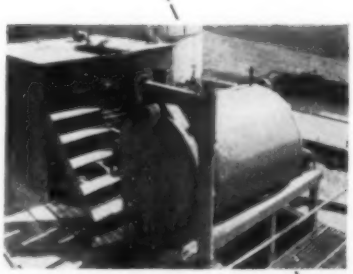

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discovery. Shell Oil Co. just completed the third producer in the new Campbell County area for 265 bbl. per day from perforations at 6,945-72 ft. The well is the 13-18 Maycock, NW SW 18-49n-75w.

Another well in the area, 43-13 Maycock, NE SE 13-49n-76w, found oil on drill-stem test. The field is only 2 months old, having been opened in July by Farmers Union Central Exchange. Shell confirmed the field as an attractive producer in the significant new Powder River basin comeback play at the east offset. Three wells drilling around the discovery well make this one of Wyoming's most closely watched fields. There is considerable activity in this portion of the basin with the Mesaverde, or Parkman, the big target.

WESTERN NEBRASKA

Muddy Discovery Reported In Banner County

Pan American Petroleum Corp. has reported significant recovery from a wildcat well in the Denver-Julesburg basin area of western Nebraska.

Pan American 1 J. R. Cross "B," located in 28-19n-56w, Banner County, swabbed oil at the rate of 10 bbl. an hour from the Muddy sand, topped at 6,162 ft. Operator is preparing to complete the well, which was drilled to a total depth of 6,240 ft., plugged back to 6,208 ft.

An earlier drill-stem test on the J. R. Cross "B" recovered 2,040 ft. of oil from the interval 6,161-67 ft. Recovery on the current test was through perforations at 6,178-82 ft. indicating 21 ft. of pay.

The wildcat is in the West Harrisburg area, 2 miles northwest of Downer field, which is the nearest production. The town of Harrisburg is 3 miles southeast of the well.

TENNESSEE

Progress Report on Wildcat Deepening

Jerre Jordan et al 1 C. W. Gray, an old Pure Oil Co. wildcat south of Memphis in Lauderdale County, drilled into the Knox formation alongside the old hole. Present depth is 3,345 ft. which is 65 ft. below the old well depth. The operator reports good drilling (20 minutes to the foot) in very hard chert and dolomite.

The 3,600-4,600-ft. mark should be reached shortly. Cores to the east of the well have shown excellent porosity, upping hopes for possible production in this section of the upper Mississippi embayment.

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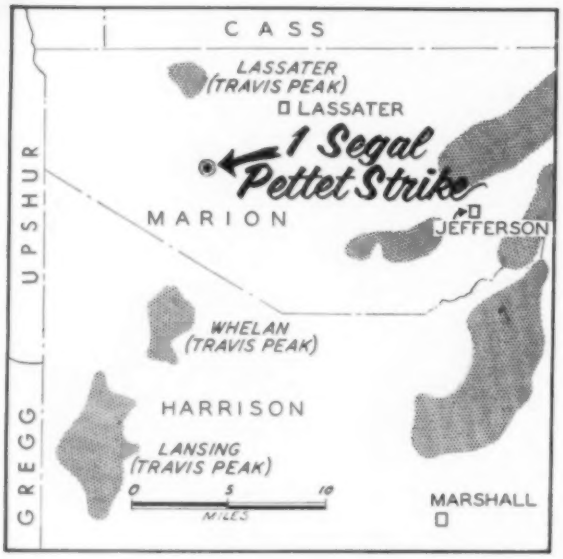

Northern Marion County scene of big Pettet opener.

TEXAS

EAST TEXAS

An excellent flowing Pettet limestone discovery has been completed in west central Marion County, and the same operators have started on an offset confirmation test.

The discovery is Great Expectations Oil Corp., Fort Worth, and Amerada Petroleum Corp. 1 Issie Segal, 14 miles west of Jefferson, in the James Wimberly Survey.

Final potential was at the rate of 541 bbl. of 41°-gravity oil a day, through ¼-in. choke. Flowing pressure on tubing was 500 psi. and gas-oil ratio was 385:1. Travis Peak perforations were at 7,503-09 ft.

Operators had swabbed acid water and oil after perforating and treating, then retreated with 9,000 gal., resulting in a heavy flow of oil and residue to pits.

No. 1 Segal was drilled as a Travis Peak exploration, and had made extensive tests after fracturing that formation at 7,503-09 ft. Total depth was 7,569 ft.

The same operators' prepared to drill a northwest offset as a confirmation test. This will be the 1 Sid Dorgan heirs and location is in Robert W. Madden Survey. Great Expectations and Amerada hold approximately 4,500 acres in the area.

Palestine Salt Dome Test Slated

T. J. Johnson and Philip B. Berry, Tyler independent operators, have made location for a Woodbine wildcat 4½ miles west of Palestine in central Anderson County. Location is on a 54-acre tract in the E. G. Myers Survey, A-48, which falls on the west, and slightly northern, flank of Palestine salt dome, according to some field maps.

The proposed test will be 1 W. A. Armstrong, contracted to 5,000 ft. The site is about ½ mile northwest of B. A. Kaemmerer 1 Tippen, drilled to 4,300 ft. earlier this year, on the northeast side of the dome.

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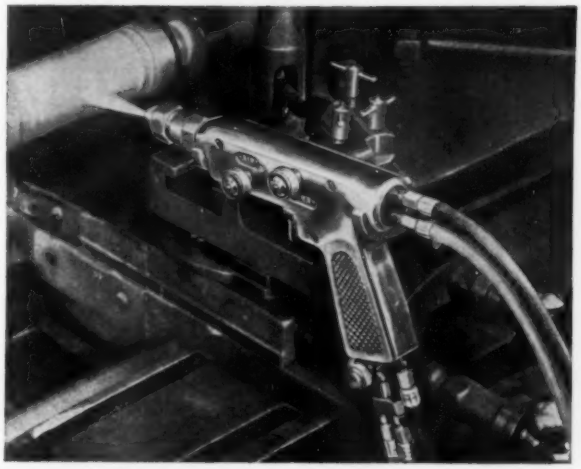

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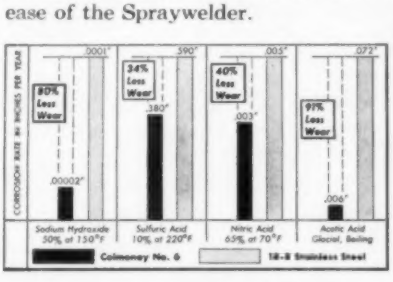

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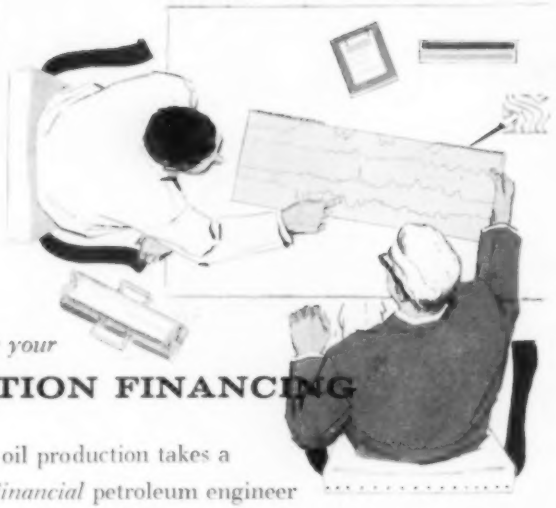

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Central Andrews County Has Two New Prospects

Andrews County had two pool openers showing last week, one of which flowed oil, and the other unloaded. Both tests were in a Pennsylvanian section.

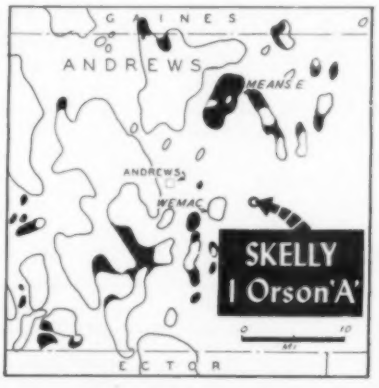
Skelly Oil Co. 1 Orson "A" drill-stem tested at 10,402-27 ft. Gas surfaced in 4 minutes and fluid in 25 minutes. After cleaning into tanks for 15 minutes, the well gaged 85 bbl. of oil in 3 hours through ⅝-in. choke. Bottom-hole flowing pressure ranged from 605-965 psi., and 30-minute shut-in pressure reached 3,635 psi. Top of the Pennsylvanian was 10,090 ft. on elevation of 3,043 ft.

Location is approximately SE SE Section 33, Block 3, PSL Survey, 10 miles southeast of Andrews, and 3½ miles southeast of Wemac multiple-pay field. Originally the test was scheduled for 10,000 ft., but at last report was drilling ahead below 10,584 ft

The other wildcat showing Pennsylvanian oil is The Texas Co. 1 Frank Orson, about 3 miles northwest of Skelly's test, in Section 27, Block 3, PSL Survey.

A 3-hour drill-stem test at 10,550-10,610 ft. unloaded 7,500 ft. of clean oil. The section tested was in the Pennsylvanian, but other details were lacking. Operators drilled ahead. Scheduled depth is 14,275 ft., to test the Ellenburger.

In northeastern Andrews County, Pan American Petroleum Corp. 2 University "BZ," Section 5, Block 5, University Lands, recovered free oil on a test at 12,325-12,421 ft. Gas surfaced in 2½ minutes and recovery was 720 ft. of free oil, 2,250 ft. of oil and gas-



Skelly Oil Co. 1 Orson "A" was one of several Andrews County wildcats showing for discoveries. Dark shaded areas around field outlines represent extension drilling over the past 6 to 8 months.

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cut water blanket, plus 170 ft. of heavily oil-cut mud. Flowing pressure reached 1,000 psi, and 3,890 psi. when shut in 15 minutes. The section tested was not identified.

Pan American Petroleum's well is 4 miles north of Northeast Andrews field, and a southeast offset to the same firm's 1 University "BZ," recent Queen discovery.

Distillate Discovery In Azalea Area

Amarillo Oil Co. and Murphy H. Baxter 1 Golliday, northeast of production in Azalea field, northeast Midland County, flowed heavily from the Devonian. The new well is referred to as an extension to Azalea, although it is more than 1½ miles from nearest production.

An 8-hour flow test at 1 Golliday gaged 336.96 bbl. of 58°-gravity oil, for a calculated daily rate of better than 1,010 bbl. Gas-oil ratio was 3,875:1 Production was from the Devonian at 11,360-11,570 ft. Azalea field has high-gravity production from the Devonian, plus oil in the Pennsylvanian Strawn.

NORTH TEXAS

Central Montague County Gets New Strike

A new conglomerate discovery has been opened 8 miles east and slightly south of Montague, in Montague County. The well is Lloyd H. Smith and Michael Judd 1 McDonald, J. B. Miller Survey, A-460.

On completion potential, the well flowed 123 bbl. of 40°-gravity oil a day through 18/64-in. choke, from conglomerate perforations at 6,546-51 ft. Tubing pressure was 85 psi., with gas-oil ratio of 420:1. Total depth was 7,065 ft.

A drill-stem test, before completion, at 6,548-58 ft., recovered 1,200 ft. of oil in 1 hour, under flowing pressure that reached 395 psi., and 2,505 psi. shut-in pressure.

Location is 2 miles northeast of Tyemond townsite, 1 miles southeast of 6,550-ft. production, and ½ mile southeast of a 7,117-ft. dry hole.

Dual Well Opens New Pay at Strawn Discovery

Sam Boren 1 B. W. King, in northeastern Young County, has been completed as a dual well. The conglomerate zone was completed as a new pay zone, while the Strawn section was a confirmation to the field's recent Strawn discovery.

Potential was 242 bbl. of 43°-gravity oil a day from the conglomerate at 2,975-83 ft. The gage was through 16/64-in. choke on tubing, under pressure of 280 psi. and gas-oil ratio of 674:1.

Strawn perforations at 3,002-10 ft. flowed 292 bbl. of 43°-gravity oil a day through 16/64-in. choke, under flowing pressure of 180 psi. Gas-oil ratio was 711:1.

The discovery is located 3 miles southwest of Loving townsite, in Sec tion 1954, TE&L Survey. The field opener was Radar Oil & Exploration Co. 3 Kenneth McCluer.

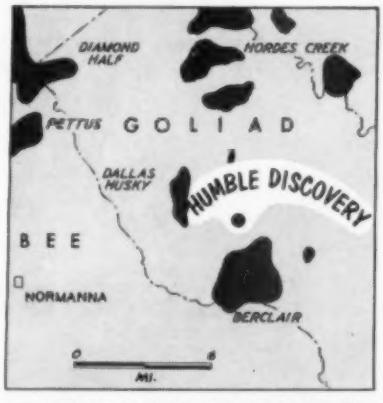
TEXAS GULF COAST

Yegua Sand Produces In Goliad County Wildcat

Humble Oil & Refining Co.'s newly completed discovery well 4 miles northwest of Berclair, in northwestern Goliad County, is rated good for 4,800,000 cu. ft. of gas per day, open flow, with a liquid recovery of 6.7 bbl. per 1,000,000 cu. ft. Liquid is 57.5°-gravity condensate. Shut-in pressure is 1,844 psi.

The well is the company's 1 Carlyle Wilkinson, in the J. Callaghan Survey. It is productive from 43 ft. of perforations opposite Yegua sand in four intervals from 4,737 ft. to 4,794 ft. It had been drilled to 12,000 ft.

Location is about 2 miles north of Berclair field, on the Goliad-Bee county line, and about 3 miles southeast of Dallas Husky field. Berclair, discovered in 1951, produces from Frio, Vicksburg, and Wilcox sands. Dallas Husky, discovered in 1953, has Yegua production.



LOCATION of Humble Oil & Refining Co.'s new gas-condensate discovery in northwestern Goliad County.

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ACCO TRADE MARK

Eight Discoveries This Year in Lipscomb

Lipscomb County in the far northeastern corner of the Texas Panhandle boasts four new gas fields and living up to earlier expectations has become another "Hansford and Ochiltree."

Sun Oil Co. opened a Cherokee-Pennsylvanian gas reservoir 8 miles northeast of Lipscomb at 1 R. B. Tyson "A" in the east-central part of the county. The well flowed 11,500 M.c.f. of gas per day plus 27 bbl. distillate in 4 hours from perforations at 8,841-59 ft. on calculated absolute open flow test. This discovery is in Section 624, Block 43, H&TC Survey.

Humble Oil & Refining Co. 1 Doyle in the eastern part of the county near the Oklahoma line flowed at the estimated rate of 1,500 M.c.f. daily from ultra-deep Morrow-Pennsylvanian perforations at 10,086 - 10,114 ft. This wildcat is 11 miles north of Higgins in Section 705, Block 43, H&TC Survey.

Sinclair Oil & Gas Co. 1 Loesch in the northwestern part of the county, 12 miles northwest of Lipscomb in Section 945, Block 43, H&TC Survey, is waiting on potential after flowing 1,200 M.c.f. per day from the Tonkawa-Penn at 6,308-20 ft.

In the southeastern part of the county, The Texas Co. 1 Barton flowed 2,750 M.c.f. of gas per day from perforations at 10,680-10,718 ft. in the Morrow sand. This one is 6 miles northeast of Higgins in Section 525, Block 43, H&TC.

There have been four discoveries in Lipscomb County thus far this year in addition to the above. They are: Humble 1 Reba Miller, 6 miles northeast of Lipscomb, a gas - condensate Morrow (Keep sand) discovery; Pan American 1 Duke, 5 miles northeast of Lipscomb, a Tonkawa gas discovery; Humble 1 Schultz Bros., 5 miles northeast of Lipscomb, a gas-condensate discovery in the Morrow sand; and Humble 1 Cowan, 1.2 miles southwest of Lipscomb, a Morrow gas-condensate discovery.

Lipscomb County until last year had no production. It is located in the deeper part of the northwestern Anadarko basin. Production in recent months has been tapped in the deep Pennsylvanian sands, mainly the Cherokee, Tonkawa, and Morrow. The deepest Morrow sand production on record is in this county and in Hemphill County to the south. For the past several years most Texas Panhandle activity has been confined to flush Hansford and Ochiltree counties just

(Continued on page 243)

Progress Report on New Computer Developments

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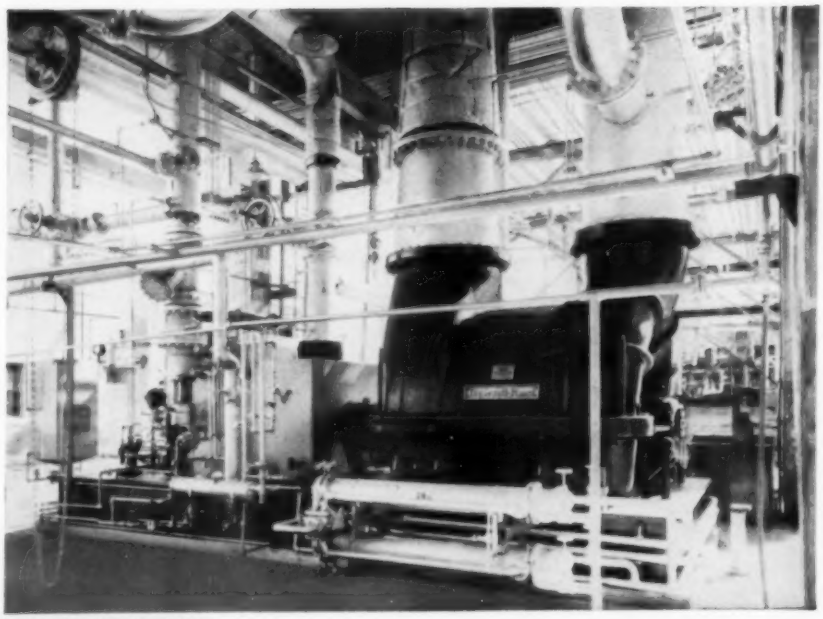

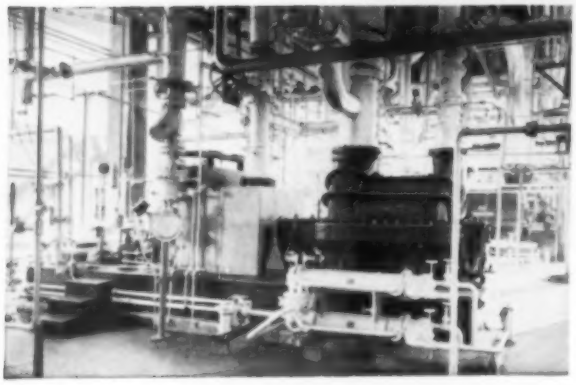

Main air blower for the cat-cracking unit is a 50,500-cfm capacity Ingersoll-Rand centrifugal driven by a 3600-hp I-R multi-stage, multi-valve steam turbine. The blower operates at 3500 rpm and delivers air at 30 psia.

Cat gas compressor has a capacity of 10,200 cfm. It is a 2300-hp, 6600-rpm unit with discharge pressure of 120 psia. Like the main air blower, it is driven by an I-R turbine operating at steam conditions of 580 psig, 700° F.T.T., 130 psig back pressure.

THIS installation of I-R centrifugals, which also includes a 5050-cfm capacity control air blower, is typical of Ingersoll-Rand's ability to provide all the air- and gas-handling equipment for any catalytic cracking process. Every I-R centrifugal is designed and built for maximum dependability and long-range economy in the particular service for which it is intended. When expansion or modernization involves new air- and gas-handling equipment, be sure to consult your Ingersoll-Rand representative. 12-634

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TEXAS PANHANDLE

(Continued from page 238)

west of Lipscomb. It has been anticipated that the Penn play would move into Lipscomb, and this year's score thus far bears the prediction out.

Another Discovery Indicated In New Oldham Area

Shell Oil Co. has an indicated discovery at its 1 Alamosa Ranch "B," 11 miles north of Vega and 6 miles southeast of the Alamosa Ranch discovery well in Oldham County, Palo Duro basin.

The operator is drilling ahead after recovering 2,100 ft. of gas in drill-pipe and 3,250 ft. of clean oil on a drill-stem test at 6,651-66 ft. in the Pennsylvanian. Oil flowed at the estimated rate of 35 bbl hourly on a test at 7,103-30 ft

Location of this indicated discovery is in Section 13, Block H-3, Capitol Lands Survey. The discovery area at Alamosa Ranch was opened by Shell earlier this summer at 1 Alamosa Ranch. That Pennsylvanian strike flowed 418 bbl. of 40°-gravity oil per day on 1-in. choke from perforations at 6,088-6,120 ft. This well opened first production in the Texas portion of the Palo Duro basin, giving the state another future petroleum province. There are two other active wildcats in the general area, one at Hunt Oil Co. 1 Alamosa and the other at Shell 1 L-S Ranch (this one is also an indicated discovery)

Petroleum Review, Dawson, Martin Counties

Phifer Petroleum Publications, Houston, has announced another of its series of Petroleum Review books on West Texas. The latest covers Dawson and Martin counties.

These books contain a chronological list of all oil and gas fields in the counties. Data on each field is up to July 1, 1957; it includes the discovery well, discovery method, formation tops, deepest zone tested, production allocation, number of producing wells, operators in the area, market outlet and other pertinent information. Number of wells, with cumulative production is through the year 1956.

Illustrations include county, field and contour maps; electric logs where available, and a typical geological chart for West Texas.

Copies and further information may be had by writing to P. O. Box 20,024, Houston.

Successful Wildcats

ALBERTA

Humber Kelmac Charter 14-25-31-10 Reist, LSD 14, 25-31-10w4. TD 3,720 ft. Jefferson oil well.

Jefferson Lake CPR 27-6 North Calgary, LSD 6, 27-25-29w4. TD 8,915 ft. Mississippian gas well.

Fargo H.B. 9-13-26-2 Acadia Valley, LSD 9, 13-26-2w4. TD 3,220 ft. Viking gas well.

CALIFORNIA

Kern County: Intex Oil Co. 1 Jones, SW SE 21-26s-28e, 10 BOPD, 14° gravity, 60 per cent cut. perfs. 1,436-52 ft. TD 1,469 ft. (Successful extension test ½ mile southeast of production in Dominion area of Mount Poso field.)

Kern County: Steele Petroleum Co. 2 Jones, SW NE 29-26s-28e, 84 BOPD, 14° gravity, 0.1 per cent cut, TD 1,713 ft. (New fault block discovery between Dominion and main area of Mount Poso field, 2,000 ft. from nearest producer.)

Ventura County: Richfield Oil Corp. 3 Richfield-Doheny-Laubacher-Fleischer, SE SE 31-2n-22w, 161 BOPD, 14.8° gravity, 1 per cent cut, open choke, 30 M.c.f. gas, perfs. 10,606-10,577 ft. TD 14,560 ft., plugged at 10,606 ft. (New pool discovery 2,200 ft. southeast of nearest Colonia pool producer in West Montalvo field.)

Ventura County: Nealy Exploration Co. 2 Delpy, NE NW 24-4n-22w, 18 BOPD, 10.5°-gravity, 4 per cent cut, TD 2,400 ft. (New pool discovery in the North Sulphur Mountain area of Sulphur Mountain field.)

ILLINOIS

Wabash County: Hentry P. Smith 1 Ankenbrandt, NW SW NE 11-1s-14w. IPP 10 BOPD, 2 BWPD, McClosky 2,925-30 ft. TD 2,935 ft. Extension to North Lexington pool.

Williamson County: Ross Bartmes 1 Roberts, Minerals, SE SE SW 21-8s-4e. IPP 50 BOPD, 1 BWPD, Aux Vases 2,886-2,906 ft. TD 3,018 ft. Opens Corinth pool.

INDIANA

Vanderburgh County: Buchman and O'Neal-Wausau Petroleum Co. 1 Harris Unit, SE NW SE 19-5s-11w. IPP 136 BOPD, 22 BWPD, Aux Vases 2,606-27 ft. TD 2,735 ft. Opens North Vienne pool.

SOUTH LOUISIANA

Acadia Parish: Continental Oil Co. 1 Nodosaria Unit 11, 6-9s-3e. IP 147 BOPD and 4,000 M.c.f. daily, 5/32-in., 38.6°, TP 8,600 psi., perforations 10,042-10,-116 ft. TD 14,251 ft. (New gas pay on northeast flank Rayne field).

Allen Parish: Hunt Oil Co. 1 Adams, 15-5s-3w. IP 39 BOPD, 11/64-in., 56.5°, GOR 12,180 cu. ft. per bbl., perforations 9,506-17 ft. TD 10,008 ft. (New field—4 miles northeast of Southeast Oberlin area.)

Jefferson Davis Parish: Cheyenne Oil Corp. 1 Tupper, 29-7s-3w. IP 65.16 BOPD and 1,191.45 M.c.f. daily, 3/16-in., 53.4°, TP 2,750 psi., perforations 8,206-22 ft. TD 8,350 ft. (New pay in South Elton field.)

Jefferson Davis Parish: Pan American Petroleum Corp. and Austral Oil Exploration Co. 2 Lacassine, 31-11s-4w. IP 96 BOPD and 4,984 M.c.f. daily, 9/32-in., 45.1°, TP 8,250 psi., perforations 14,634-14,704 ft. TD 14,746 ft. (New pay in South Thornwell field.)

Plaquemines Parish: Bateman Drilling Co. 1 Arlitt et al, 35-22s-31e. IP 163 BOPD, ⅛-in., 37.6°, GOR 736 cu. ft. per bbl., perforations 8,226-34 ft., and (dual completion) 144 BOPD, ⅛-in., 37°, GOR 762 ft. per bbl., perforations 7,963-66 ft. TD 11,165 ft. (Two new pays in Felice Bayou field.)

St. Mary Parish: Union Producing Co. 1-A OCS 0479, Block 53, Eugene Island area, Gulf of Mexico. IP 4,500 M.c.f. daily, 3/16-in., shut-in pressure 8,507 psi., perforations 12,275-85 ft. TD 14,040 ft. (New offshore field.)

Terrebonne Parish: Shell Oil Co. 3-A Continental, 49-17s-15e. IP 52 BOPD and 3,480 M.c.f. daily, 9/16-in., 46.9°, TP 8,300 psi., perforations 12,042-68 ft. TD 12,626 ft. (New gas pay—second well South Humphreys field.)

Vermilion Parish: Continental Oil Co. (Operator for C.A.T.C. Group) 1-A OCS 0494, Block 120, Vermilion area, Gulf of Mexico. IP 192 BOPD, ⅛-in., 42.6°, GOR 740 cu. ft. per bbl., perforations 8,624-29 ft., and (dual completion) 152 BOPD, ⅛-in., 42°, GOR 730 cu. ft. per bbl., perforations 8,598-8,606 ft. TD 14,025 ft. (New offshore field.)

MICHIGAN

Mecosta County: Union Development Co. 1 Tetzlaff, NW NE SE 15-15n-9w. IP 250,000 cu. ft. daily. From Dundee pay. TD 3,641 ft. New pool. (Not included above since this was rework of an abandoned wildcat.)

NORTHWEST NEW MEXICO

Rio Arriba County: Magnolia Petroleum Co. 1 Harrington-Federal, NW SE NW 28-24n-1w. IP 2,190 M.c.f. of gas per day, Pictured Cliffs discovery, new field. TD 3,240 ft. Lewis.

SOUTHEAST NEW MEXICO

Eddy County: Pan American Petroleum Corp. 1 Greenwood Unit, 27-18s-31e, 1 mi. N Shugart field. IP 13,600 M.c.f. gas, GOR 15,610:1, Devonian perforations 12,655-12,700 ft. TD 13,446 ft., elev., 3,657 ft.

Lea County: Humble Oil & Refining Co. 1 State "AU," SE SE 4-16s-33e, 9 mi. NE Maljamar. IP 576 BOPD, ¼-in., 48°-gravity, perforated Permo-Pennsylvanian 11,096-11,144 ft. TD 13,375 ft., elev. 4,237 ft.

Texas Pacific Coal & Oil Co. 1 J. P. Collier, SE NW 10-11s-33e, 8 miles SE Caprock. IP 531 BOPD, 20/64-in., 50°-gravity, GOR 4,445:1, Permo-Pennsylvanian 10,005-76 ft. TD 11,750 ft., elev. 4,275 ft.

Phillips Petroleum Co. 1 Austin, SW SW 17-14s-36e, 12 mi. S Tatum. IP 4,925 M.c.f. gas, and 152 bbl. 52-°gravity oil, Mississippian 13,194-13,208 ft. TD 14,796 ft., elev. 3,979 ft., top Devonian 14,580 ft.

PENNSYLVANIA

Indiana County, Young Township: New York State Natural Gas Corp. N-2-543 Florence Boden, elevation 1,214 ft., 2,421,000 cu. ft. gas, after fracture, rock pressure 2,485 psi., Tully 7,614 ft., Onondaga 7,314 ft. chert 7,335 ft., gas, Oriskany sand 7,470-7,498 ft. TD 7,500 ft.

Armstrong Township: T. W. Phillips Gas & Oil Co. 2 A. W. Robinson, 500,000 cu. ft., gas, Tully 7,500 ft., chert 7,520 ft. Oriskany sand 7,656 ft., gas 7,500-72 ft. TD 7,676 ft.

Westmoreland County, Mount Pleasant Township: Peoples Natural Gas Co. 4089 M. I. Keck, elev. 1,840 ft. IP 11,365 M.c.f. of gas per day, natural, gas sand 7,485 ft. TD 7,565 ft.

Foreign search upgraded, so . . .

Sohio Picks World Oil Hunter

SOHIO PETROLEUM CO. is expanding its foreign operations—and the man chosen to lead its search for oil throughout the world is a one-time electrical engineer who was sidetracked 28 years ago into geophysics.

Roy F. Bennett of Oklahoma has been promoted by Sohio to the newly created post of foreign exploration manager. Bennett's job is to find spots in the world for Sohio's expanding foreign exploration program.

Only in the last couple of years has Sohio really become world-minded in oil exploration and development. Right now its activity is confined to exploration in Venezuela, Bolivia, and Guatemala.

"But we're busily looking at the rest of the world—Africa and the Middle East," Bennett says. "We're just getting into it—and we're interested anywhere."

Bennett has just returned from a lengthy trip to Venezuela and Guatemala. He has been to Latin America three times in the past year.

He and Mrs. Bennett experienced some uneasy moments in Guatemala City July 27. That's the day President Castillo Armas was assassinated by a Communist palace guard. The Bennetts stuck pretty close to their apartment during the next few days while the country was under a "state of siege" and gatherings were limited to a maximum of four persons.

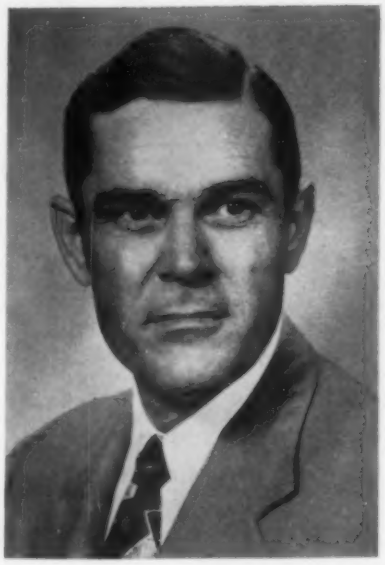
Sohio's holdings . . . Sohio has an interest in seven concessions in Guatemala with Tidewater Oil Co. and Atlantic Refining Co. No wells have yet been drilled.

In Venezuela Sohio has a 25 per cent interest in 27,000 acres in the Lake Maracaibo concession area and is now drilling its second exploratory hole. Drilling on the first well has been suspended.

In Bolivia the company has a one-third interest in 1,250,000 acres of concession land.

Bennett, in his new job, will report to Sohio's foreign operations manager, John T. Cooke, who also headquarters in Oklahoma City. An expanded staff of geologists and geophysicists is now being organized.

Background . . . A native of Stillwater, Okla., Bennett, 48, took an electrical engineering degree from Oklahoma A. & M. College (now Oklahoma State University). Because he was a ham radio operator, one of his first jobs in 1929 was to serve as communications chief for a geophysical crew in the field.



ROY F. BENNETT

. . . "We're interested anywhere."

The transition from electrical engineer to geophysicist followed—and Bennett has never regretted it.

"It's been a wonderful life working with wonderful people," he says.

He was employed by Geophysical Research Corp. and Independent Exploration Co. before joining Sohio in 1945 at Houston. In 1954 he transferred to Oklahoma City and moves into his new job after 9 years as Sohio's chief geophysicist, a position now being taken by staff geophysicist C. C. (Buddy) Sellers.

Bennett is held in high regard by the petroleum world and currently is serving as national president of the Society of Exploration Geophysicists. Under his leadership the society is promoting a scholarship program for students entering the field. Thirteen scholarships are being financed by oil companies this year through the society, compared with only one last year.

Mr. and Mrs. (Elsie) Bennett live with their two children, Ann, 22, and Roy, Jr., 21, in Oklahoma City.

Howard Boyd, vice president of El Paso Natural Gas Co., and vice chairman of the board of Pacific Northwest Pipe Line Corp., has been elected executive vice president of El Paso Natural. He will transfer to New York from Houston next month.

Personals

Thomas Christensen has been appointed mechanical engineer in Shell Oil Co.'s Denver area office. He was formerly junior mechanical engineer.

Albert K. Dittmer has been promoted by Shell Oil Co. from mechanical engineer to division mechanical engineer in Billings, Mont.

Tom Burns, division geologist in Denver with Rocket Drilling Co., has resigned to open consulting offices there. **Lee A. Lair** will replace Burns with Rocket Drilling.

Charles F. Word, Abilene, Tex., consulting geologist and independent operator since 1946, has moved to Durango, Colo., where he is with Rhodes Drilling Co. of Abilene.

L. J. Hoar, vice president of Sinclair Refining Co., has been elected 1957-58 president of the Harvard Advanced Management Association. The association has a membership of 1,000 in the United States and 20 foreign countries. Members are graduates of the Advanced Management Program of Harvard Graduate School of Business Administration.

J. O. Scott, district editor in the Tulsa office of The Oil and Gas Journal, has joined the staff of Cities Service Research & Development Co.'s Tulsa production research laboratory. Scott has been with the Journal since 1955. A graduate of Oklahoma University and the University of Michigan, he was formerly with Atlantic Refining Co. at their Dallas production research and development lab.

Jack M. Saunders has been promoted to division geologist for Continental Oil Co.'s Corpus Christi, Tex., division. Formerly assistant to Conoco's southern region geologist, Saunders succeeds **Lloyd Ryman,** who has been transferred to Caracas with Continental Oil Co. of Venezuela. **R. W. Blair** will succeed Saunders as assistant to the southern region geologist in Houston. Saunders has been with Continental since 1949. He was district geologist in Corpus Christi before becoming assistant to the regional geologist in Houston last year. He is a graduate of the University of Michigan. Blair joined Conoco in 1947. He was division geologist in Salt Lake City before transferring to Sahara Petroleum Co., Egyptian affiliate of Continental, in 1953. He returned to Continental in Houston early this year.

Personals

J. H. SMITH

J. H. Smith, Continental Oil Co.'s chief process engineer in the manufacturing department, has been promoted to manager of manufacturing for the southern and southwestern regions. He will be in charge of Conoco's refinery operations at Lake Charles, La., Artesia, N. M., and Wichita Falls. Smith succeeds **H. R. Wall,** recently appointed general manager of transportation and supplies for the company. **Daniel F. Cameron,** assistant chief process engineer in the manufacturing department, will move up to replace Smith as chief process engineer. A graduate of Purdue University, Smith has been with Continental since 1943 and had been chief process engineer since 1948. Cameron, a graduate of Polytechnical Institute in New York and the University of Tulsa, joined the company in 1951.

George E. Girouard, Jr., has left Gulf Oil Corp.'s Oklahoma City office where he was production engineer, to join Kerr-McGee Oil Industries, Inc., as secondary-recovery engineer in Oklahoma City.

Ellis H. McCawley has joined Kermit Oil Co., Kermit, Tex., as district superintendent. McCawley was formerly superintendent for Greenbrier Oil Co. in Graham, Tex.

Gordon R. Wicker and **Robert F. Knott** have joined Shell Development Co. as chemical engineers at the company's Emeryville, Calif., research center. **E. H. Catsiff** and **Joseph L. Greene** have been named chemists in the polymer and chemical applications department at Emeryville, and **John Boor, Jr.,** will be chemist in the catalysis and surface chemistry department there.

Earnest E. Campbell, district gas-department superintendent at Morgan City, La., for Magnolia Petroleum Co., has been promoted to assistant superintendent of the department at the Dallas headquarters. Campbell, as district superintendent at Morgan City, formerly was in charge of Magnolia's gas operations in the Gulf of Mexico. He has been with the company 28 years, starting as a laborer in Oklahoma. **James A. Upton** moves from district superintendent of the Seeligson district at Premont, Tex., to New Orleans to replace Campbell. **Charles A. Freeman** has moved up from assistant superintendent of the Pegasus district near Midland, Tex., to superintendent at Premont.

C. L. Wise, projects manager for Kerr-McGee Oil Industries, Inc., has been transferred to Oklahoma City from Wynnewood, Okla.

W. M. Riddle, formerly geologist with Pure Oil Co., has joined Home Stake Production Co. as geologist for the Kansas area.

W. W. Arneson, formerly on the staff of the North Dakota Oil and Gas Conservation Commission, has joined Northwest Geological Service in Billings, Mont.

R. G. Kendall has been appointed staff geologist in The California Co.'s western exploration region.

C. L. Aldridge, Leo Broussard, and **H. M. Tenney** have been named research associates at Esso Standard Oil Co.'s Baton Rouge, La., laboratories.

Harold F. Smith has been appointed research chemist in Continental Oil Co.'s petrochemical research division in Ponca City, Okla.

Ernest Solomon has been appointed associate director of M. W. Kellogg Co.'s petroleum and chemical research laboratory.

Chester Taggert, Grandfalls, Tex., has moved up from vice president to first vice president of the Association of Oil Well Servicing Contractors. He replaces **Frank M. Bateman,** who recently took over as association president.

Walter Herbst, Nat Rickles, and **Gene Corner** have been appointed research associates by Esso Research & Engineering Co. Herbst has been with the company since 1936, Rickles since 1928. Corner joined Esso in 1942.

Fred W. Argue, vice president and engineering manager of Stone & Webster Engineering Corp., has been elected a director. Argue has been with Stone & Webster since 1941. He was elected engineering manager in 1954 and a vice president in 1955.

George M. Rose has joined Tidewater Oil Co. as group leader in refinery technology at the company's Delaware City, Del., refinery. Rose was formerly with Houdry Process Corp. **Frank A. Holt** has been named shift leader in the reforming and extraction area at the Delaware refinery. Newly appointed shift leaders in the blending area include **Henry J. Fleiner, Jeff C. Hunter, Fred W. Oaks,** and **Raymond Weitzel, Jr.**

D. L. KATZ

Dr. Donald L. Katz, chairman of the University of Michigan chemical engineering department, will be lecturer at the second E. P. Schoch Lecture Series, which has been scheduled for October 15 and 16 at Batts Hall, University of Texas, Austin. His topic will be "Phase Equilibria at Low and High Pressures." Katz is winner of the Hanlon Award of Natural Gasoline Association of America. **Dr. W. K. Lewis** was speaker at the first lectures last year.

Bill C. Bond, geological consultant, has moved his offices from Meeker, Colo., to Grand Junction, Colo.

L. Guy Huntley, geologist, has been transferred by Carter Oil Co. from Tulsa to Oklahoma City.

Jack R. Gollnick, Shell Oil Co. production geologist in Denver, has been promoted to area production geologist there.

George Martinek, Jr., tool pusher with Eason Oil Co., has been transferred to Buffalo, Okla., from Duncan, Okla.

Menno Schepers, Shell Oil Co. exploitation engineer in the Denver area office, has been transferred to Billings, Mont., as reservoir engineer. **David F. Toomey,** mechanical engineer in Billings, will move to Denver as drilling engineer.

Raymond H. Coe has been promoted by Tidewater Oil Co. from central division petroleum engineer to assistant manager of production. **Wendell J. Haugh** will succeed Coe as division petroleum engineer.

A. E. Barroll, production superintendent for Mobil Oil of Canada, Ltd., has been named manager of exploitation for Mobil Overseas Oil Co., with headquarters in Paris. In another appointment to a Mobil foreign affiliate, **D. G. Price,** district production superintendent in Regina, has been named drilling superintendent for Mobil Exploration Portugal, Inc. Barroll, a graduate of the University of Oklahoma, joined Mobil Oil of Canada in 1950. Price has been with the company since 1936. He became district production superintendent last year.

Personals

E. Q. Camp and **J. C. Schiller** have been promoted to assistant division heads in the research and development division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. Camp is in charge of sections doing research on fuels and lubricants, corrosion, and air and steam pollution abatement. Schiller will supervise sections doing

E. Q. CAMP

J. C. SCHILLER

petrochemical research, and a group of research specialists. Four section heads have also been named by Humble at Baytown. They are **S. R. Bethea,** head of lubricants research; **M. R. Morrow,** head of research on gasolines, distillates, and solvents; **M. A. Moseman,** analytical research; and **C. E. Zerwekh,** new technical information.

Don Baremore, tool pusher with Cactus Drilling Co., has been transferred to Kermit, Tex., from Big Lake, Tex.

R. H. Tipton, assistant superintendent of Loffland Brothers Co.'s West Texas-New Mexico division, has been appointed acting superintendent of the division succeeding **J. D. Poe.** Tipton has been with Loffland since 1930.

T. R. Brennan, field superintendent of mainline stations with Natural Gas Pipeline Co. of America, has been promoted to field superintendent of compressor stations (gathering system). He succeeds the late G. W. Gibbs. **J. E. Bullock,** superintendent of the company's Fritch, Tex., station, moves up to succeed Brennan as field superintendent of compressor stations (mainline). Brennan, formerly in Beatrice, Neb., will headquarter in Fritch. Bullock will transfer to Beatrice. In other appointments, **L. L. Stallard,** assistant superintendent at Fritch, succeeds Bullock as superintendent there. **D. R. Wendele,** superintendent of station 103 at Minneola, Kans., has been transferred to Fritch to replace Stallard as assistant superintendent. **C. J. Fitzgerald,** Chicago, has been transferred to Minneola as superintendent, succeeding Wendele.

Kenneth Rea, formerly a driller for Gulf Oil Corp. in Mozambique, is now a tool pusher for Slim Rea Drilling Co. in Abilene, Tex.

John Pfeifauf has been appointed coordinator of seismic operations for Arabian American Oil Co. Pfeifauf has been seismic party chief in The Texas Co.'s Oklahoma division producing department.

M. G. Frey has been named chief geologist, exploration, in The California Co.'s eastern region at New Orleans. Frey succeeds **H. T. Richardson,** recently transferred to Standard Oil Co. of Texas as chief geologist.

R. J. Graebner, senior research seismologist with Geophysical Service, Inc., has been appointed geophysicist for U. S. and Canadian operations. A graduate of the University of Colorado, Graebner has been with G.S.I. since 1949.

Ralph M. Barger, senior engineer with the division of oil and gas of the California Department of Natural Resources, has been transferred from Bakersfield, Calif., to Taft, Calif., where he will be senior oil and gas engineer.

Langdon Dearborn has been named vice president, general manager and a director of Houston Natural Gas Production Co. Dearborn was with Progress Petroleum, Inc., before its sale a year ago. He has been an independent in Houston since that time.

Robert M. Chan, first vice president of Magnolia Petroleum Co., retired September 1 after 22 years with the company. Chan, originally in the investment consulting business, switched to oil in 1929 with Vacuum Investing Co., subsidiary of Vacuum Oil Co. He became vice president of that firm in 1931 and joined Magnolia at Dallas in July 1935 following the formation Socony-Vacuum (now Socony Mobil) Oil Co., Inc. He was named assistant vice president and director of Magnolia in 1942, vice president in 1945, and first vice president in 1952. Chan played key roles in many of Magnolia's major moves. He helped guide the company's strong entry into the natural-gas field when interstate movement of gas was still in its infancy. More recently, he was in the forefront in the company's heavy investment in L.P.G. facilities in West Texas and along the Gulf Coast. Chan served at one time as vice president, general manager, and later president of Harrison Oil Co., Magnolia subsidiary.

D. H. Condit has been named assistant to the general manager of California Research Corp.'s Richmond, Calif., laboratory.

Charles A. Reass has been appointed chief chemist at Esso Standard Oil Co.'s Everett, Mass., refinery. Reass succeeds **John E. Marr,** who recently retired.

D. G. Smith has been appointed general manager of the new petroleum chemicals department of British Petroleum Co., Ltd. **Dr. D. A. Howes** will be assistant general manager. B.P. is making several changes in its refineries and technical department as a result of the new petrochem group. **M. A. L. Banks** has been named general manager of refineries. He succeeds **C. E. Spearing,** recently named a director of BP Trading, Ltd. **S. E. Adey** will be deputy manager of refineries. Assistant general managers will be **J. Moffat,** in charge of United Kingdom and European refineries, and **D. W. K. Barker,** in charge of Eastern and Commonwealth refineries. **P. Docksey** has been named coordinator of research and development.

DEATHS

Henry Suhr, 55, director and member of the executive committee of South Penn Oil Co., died August 27 in Pittsburgh. Suhr, prominent in civic affairs in his home of Oil City, Pa., was the son of **Charles Suhr,** South Penn board chairman.

George Granger Brown, dean of the University of Michigan College of Engineering since 1951 and special consultant to the industry for many years, died August 28 in Ann Arbor, Mich. Brown was a past president of American Institute of Chemical Engineers and was also closely connected with Natural Gasoline Association of America. In the 1930's he conducted a research program for N.G.A.A. In 1940 he received the coveted N.G.A.A. Hanlon Award. In 1949 Brown was named director of the U. S. Atomic Energy Commission's Division of Engineering.

Paul H. Grauheding, 59, member of the research staff of Socony Mobil Oil Co., Inc., in Paulsboro, N. J. died August 25 in Millville, N. J.

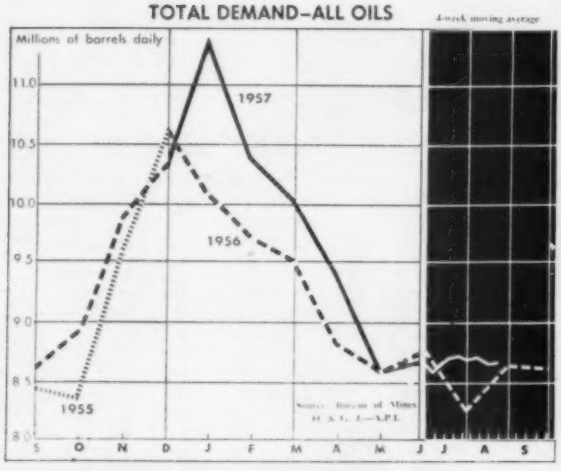
George Newberger, 86, one of the founders of Richfield Oil Co., forerunner of Richfield Oil Corp., died August 26 at his home in Los Angeles.

Theryl B. Knox, 56, president of Donnell Drilling Co., Dallas, died August 27 in a Fort Worth hospital.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,819,550	DOWN	16,375	DOWN	395,345
Crude stocks	286,618,000	UP	2,246,000	UP	9,553,000
Completions	1,075	DOWN	43	DOWN	72
Refinery runs	7,970,000	UP	1,000	UP	27,000
Gasoline stocks	171,897,000	DOWN	239,000	DOWN	3,919,000
Kerosine stocks	33,219,000	UP	198,000	UP	1,698,000
Distillate stocks	149,671,000	UP	2,968,000	UP	15,290,000
Residual stocks	52,237,000	UP	1,314,000	UP	6,168,000
Four-product stocks	407,024,000	UP	4,241,000	UP	19,237,000
Total imports	1,609,800	DOWN	100	UP	122,300



Labor Day Look: A Teetering Supply-Demand Relationship

THIS IS Labor Day, the turn of the season, the time when the fall pickup in business is supposed to start, the time for the oil industry to look at its supply-demand situation. It doesn't look good.

There's just one bright spot on the map: the gasoline market in the North Central states. It's firm and seems to be getting firmer. Guesses as to why include late vacationing, farm and construction use shoved back by a wet spring, prolonged strikes at several refineries, a cautious policy of many refiners in holding their runs down.

Anyway, refiners' stocks in the Midwest are low and demand stays brisk. This is expected to continue for another 30 days or more, even though some of the struck refineries are now back on stream and some surplus gasoline is heading upriver on barges.

Uncomfortably comfortable . . . Throughout the rest of the world, it seems that nobody but nobody wants to buy any crude oil or refined products. There's almost no such thing as a bona fide spot market caused by operators picking up extra supplies to augment their normal flow. Everybody has enough—or too much—on hand or in sight as it is. Empty bulk storage is getting hard to locate.

Things could have been worse than they are. Apparently refiners as a whole sensed that demand is below what was forecast, for they have kept their runs somewhat below last year's level all summer. This has reduced gasoline stocks to a smidgin below what they were last year at this time—but they were too high then.

Stocks of distillates and fuel oil are so high, and could be augmented so easily, that if dealers and big users anticipate a cold winter they also anticipate that they'll be able to get plenty of oil later on and at attractive prices. Certainly there's not the slightest sign of a fall pickup in interest in these products.

By holding down runs, a good many refiners have kept their operations reasonably in balance, despite their ample inventories. One of them described his position as "uncomfortably comfortable"—meaning that some little market blow could upset his apple cart.

Now the military . . . That blow may have been struck by Uncle Sam. Under Congress' economy lash, the military has cut back its fuel contracts drastically. The reduction in aviation gasoline takings has made alkylate a drug on the market. This seriously threatens the already shaky price of premium motor gasoline, particularly on the Gulf Coast. Canceled contracts for jet fuel and Navy Special, though not quite so voluminous, could have a similar effect on distillates and Bunker C.

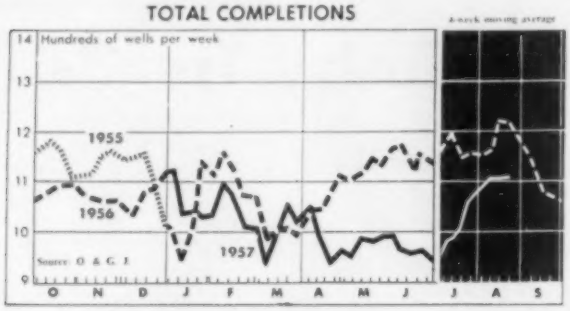
To offset that, there's word that some majors are quietly cutting refinery runs this week. That's smart if true—and widespread.

As for crude . . . Of course, cutting runs piles up crude stocks even more. They're already near top limits, and some refiners are really suffering from jam-full storage. That's why there's so much purchaser prorating—a condition that may get worse before it gets better.

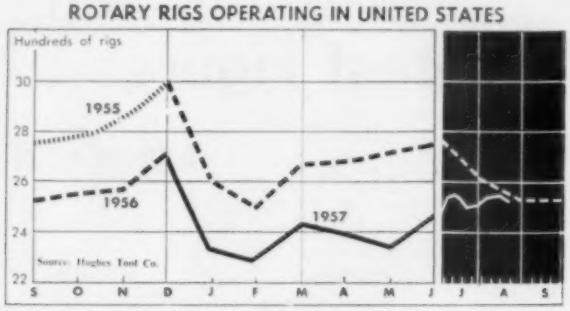
But there's this bright side: It looks as though some refiners are quietly trying to protect the whole price structure by restraining runs and keeping their biggest inventories in crude rather than in products. If this works, and if production allowables are kept down commensurately, the industry may squeeze through the fall without a disastrous break in either crude or products prices.

Beyond that, pin your hopes on a cold, dry—and early—winter.

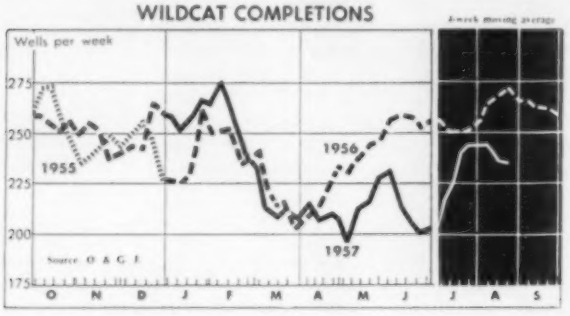
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	8-26-57	8-19-57	8-27-56
North Central and East	106	103	134
Southeast	43	43	34
Okla., Kans., Ark., Mo.	426	449	457
Louisiana	455	444	438
North and East Texas-Panhandle	343	362	379
Gulf and South Texas	210	207	233
West Texas-New Mexico	523	553	465
Rocky Mountain	297	279	278
Pacific Coast	105	112	118
Total United States	2,508	2,552	2,536
Canada	192	183	257

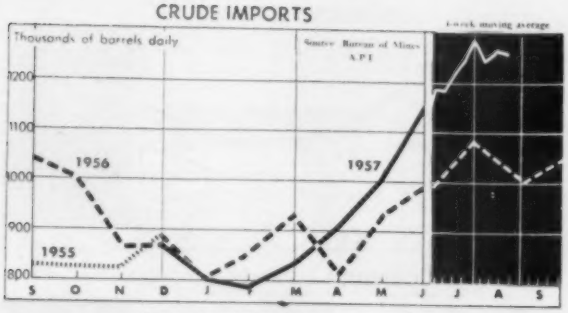
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 24, 1957

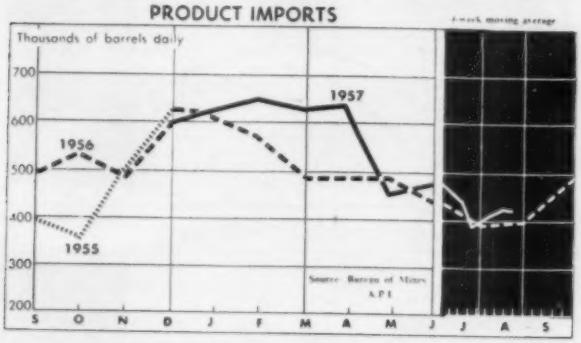
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1957	1956	Total	Crude	Cond.	Gas	Dry	1957	1956
Alabama	1	0	0	0	1	0	1,500	62	‡73	1	0	0	0	1	20	‡31
Arkansas	27	21	0	0	6	0	75,667	707	555	3	0	0	0	3	129	121
California	45	24	0	3	16	2	188,262	1,388	1,434	11	1	0	0	10	344	322
Colorado	10	0	0	1	9	0	49,849	548	762	8	0	0	1	7	371	388
Illinois	66	23	0	0	43	0	159,677	1,646	2,500	21	1	0	0	20	421	489
Indiana	11	2	0	0	9	0	16,254	399	422	2	0	0	0	2	80	89
Kansas	87	38	0	5	43	1	308,015	2,704	3,327	20	1	0	0	19	545	697
Kentucky	34	18	0	0	16	0	42,849	921	1,184	3	0	0	0	3	182	278
Louisiana	66	29	3	6	28	0	462,428	2,440	2,515	11	0	1	1	9	435	503
North	30	18	0	2	10	0	83,991	858	1,075	3	0	0	0	3	114	166
South	29	8	3	3	15	0	310,465	1,122	1,153	7	0	1	0	6	263	284
Offshore	7	3	0	1	3	0	67,972	460	287	1	0	0	1	0	58	53
Michigan	5	1	0	0	4	0	16,169	264	288	3	0	0	0	3	99	107
Mississippi	6	0	0	0	6	0	37,206	236	290	5	0	0	0	5	126	138
Montana	13	4	0	0	9	0	46,320	256	276	7	0	0	0	7	93	101
Nebraska	29	11	0	0	18	0	178,791	577	667	14	3	0	0	11	319	324
New Mexico	38	23	0	7	8	0	133,159	1,361	1,266	6	0	0	0	6	181	168
Northwest	19	6	0	7	6	0	27,305	544	508	5	0	0	0	5	67	50
Southeast	19	17	0	0	2	0	105,854	817	758	1	0	0	0	1	114	118
New York	9	4	0	0	0	5	9,250	297	.....	0	0	0	0	0	4	.....
North Dakota	4	1	0	0	3	0	25,252	176	163	4	1	0	0	3	76	51
Ohio	22	10	0	3	5	4	46,404	710	657	2	1	0	0	1	9	6
Oklahoma	136	77	2	6	48	3	439,972	4,025	5,626	9	0	0	0	9	456	585
Pennsylvania	0	0	0	0	0	0	0	442	†750	0	0	0	0	0	39	†16
Texas	417	244	6	11	154	2	1,772,970	14,132	14,657	84	5	1	0	78	3,480	3,709
District 1	24	7	0	0	17	0	69,077	820	*2,122	11	1	0	0	10	287	*717
District 2	8	0	0	2	6	0	42,893	496	*1,736	5	0	0	0	5	187	*552
District 3	35	15	2	0	18	0	210,312	1,133	.....	7	0	0	0	7	330	.....
District 4	32	14	3	1	12	2	163,509	916	.....	6	0	1	0	5	309	.....
East	23	18	0	0	5	0	110,164	835	754	5	1	0	0	4	244	272
District 7-B	74	44	0	0	30	0	156,213	1,853	.....	17	2	0	0	15	661	.....
West	125	96	0	1	28	0	720,156	4,014	3,926	14	1	0	0	13	588	631
District 9	78	42	0	2	34	0	231,809	3,129	*5,246	18	0	0	0	18	802	*1,459
District 10	18	8	1	5	4	0	68,837	936	873	1	0	0	0	1	72	78
Utah	4	2	0	0	2	0	18,585	133	83	1	0	0	0	1	72	49
West Virginia	19	6	0	11	2	0	44,356	417	424	0	0	0	0	0	19	13
Wyoming	23	10	0	0	13	0	94,563	545	537	11	0	0	0	11	188	149
Misc. (S. D., Ariz.)	3	0	0	0	3	0	10,360	65	70	3	0	0	0	3	48	62
Total U. S.	**1,075**	548	11	53	446	17	4,177,858	34,451	38,526	**229**	13	2	2	212	7,736	8,396
Total prev. week	1,118	564	16	80	436	22	4,638,607	.....	.....	243	20	0	4	219	.....	.....
Cum. 1957	34,451	17,888	312	2,481	13,049	721	142,766,465	.....	.....	7,736	800	65	281	6,590	.....	.....
Western Canada	56	30	0	6	20	0	254,989	1,993	1,899	17	1	0	2	14	570	.....

*Districts: 2 & 3, 1 & 4, 9 & 7-B, formerly combined. †Incl. New York. ‡Incl. Florida and Georgia.

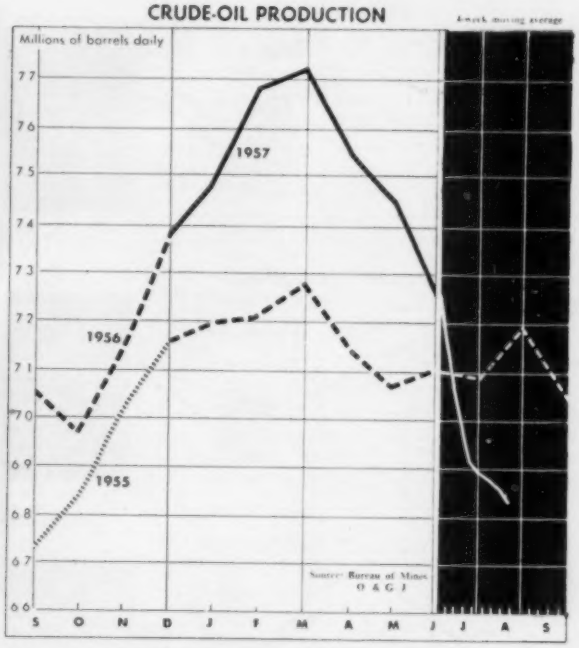
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

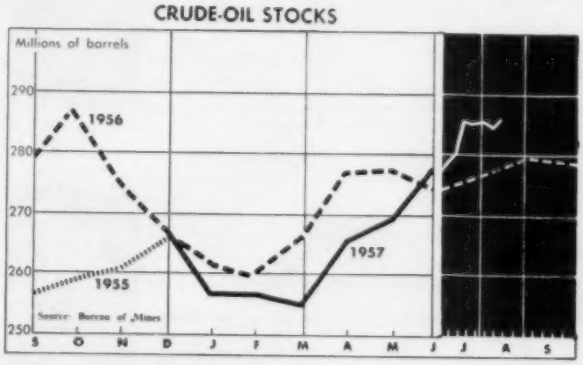


DAILY AVERAGE PRODUCTION FOR WEEK

	August 24, 1957			Aug. 17
	Crude oil	Lease condensate	Total	total
Alabama	13,750	.....	13,750	13,675
Arkansas	85,300	300	85,600	85,200
California	924,100	.....	924,100	924,600
Colorado	151,150	.....	151,150	150,600
Eastern	52,300	.....	52,300	52,800
Florida	1,300	.....	1,300	1,300
Illinois	165,500	.....	165,500	163,300
Indiana	29,500	.....	29,500	27,800
Kansas	†339,400	.....	†339,400	†351,900
Kentucky	39,400	.....	39,400	39,300
Louisiana	723,000	72,500	795,500	795,600
North	123,000	2,500	125,500	125,600
South	600,000	70,000	670,000	670,000
Michigan	25,900	.....	25,900	25,200
Mississippi	103,800	4,400	108,200	108,200
Montana	76,450	.....	76,450	74,700
Nebraska	52,100	.....	52,100	52,050
Nevada	100	.....	100	100
New Mexico	245,800	3,900	249,700	249,700
North Dakota	31,100	.....	31,100	39,850
Oklahoma	†565,400	.....	†565,400	†562,600
Texas	2,760,000	53,700	2,813,700	2,813,700
Dist. 1	51,000	450	51,450	51,450
Dist. 2	126,000	8,450	134,450	134,450
Dist. 3	404,000	26,400	430,400	430,400
Dist. 4	210,000	6,200	216,200	216,200
Dist. 5	36,000	300	36,300	36,300
Dist. 6	122,000	6,300	128,300	128,300
East Texas Field	173,000	.....	173,000	173,000
Dist. 7-B	151,000	50	151,050	151,050
Dist. 7-C	143,000	3,575	146,575	146,575
Dist. 8	1,033,000	1,200	1,034,200	1,034,200
Dist. 9	204,000	350	204,350	204,350
Dist. 10	107,000	425	107,425	107,425
Utah	10,200	.....	10,200	11,500
Wyoming	288,950	.....	288,950	292,100
Others	‡250	.....	‡250	‡150
Total U. S.	6,684,750	134,800	**6,819,550**	6,835,925
Change from previous week, down			**16,375**	
Canada	†426,197	.....	†426,197	†430,143
Total U. S. production—January 1-August 24			1,739,302,775 bbl.	
Same period last year (crude plus cond.)			*1,696,885,104 bbl.	

*Includes 29,234,,830 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



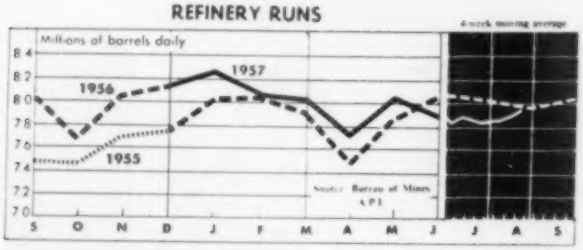
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

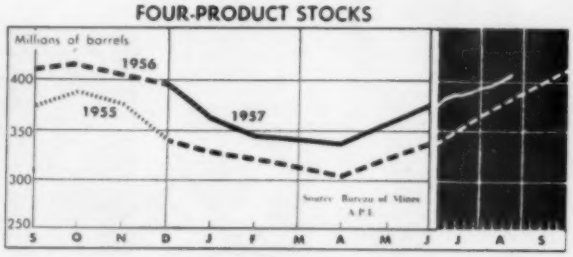
	8-17-57	8-10-57	8-18-56
Pennsylvanian Grade	3,158	3,052	2,583
Other Appalachian	1,624	1,635	2,412
Illinois, Indiana, and Michigan	11,106	11,391	10,907
Nebraska and North Dakota	2,546	2,451	2,188
Kansas	10,810	10,732	9,045
Oklahoma	22,990	22,413	27,428
Arkansas	2,743	2,619	2,644
Louisiana	18,577	18,663	16,470
North	3,082	3,092	2,674
South	15,495	15,571	13,796
Mississippi, Ala., and Fla.	2,665	2,609	3,261
New Mexico	8,716	8,995	7,880
Texas	131,376	127,959	123,854
East Texas proper	10,765	10,670	9,528
West Texas	64,408	61,792	60,172
Texas Gulf	24,292	23,646	22,513
Other Texas	31,911	31,851	31,641
Wyoming	17,835	17,817	19,802
Other Rocky Mountain	6,285	6,419	6,754
California	30,075	30,244	28,034
Foreign	†16,112	17,373	13,803
Total	286,618	284,372	277,065

*Bureau of Mines. †Includes 3,903,000 bbl. in California.

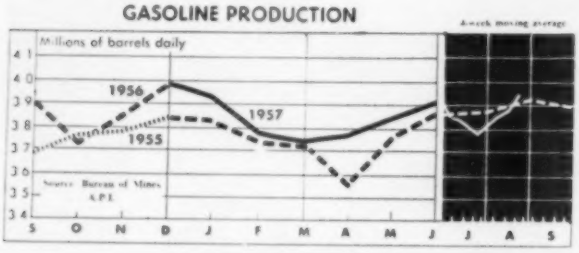
REFINERY RUNS



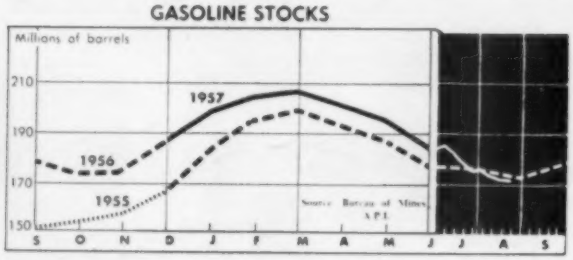
FOUR-PRODUCT STOCKS



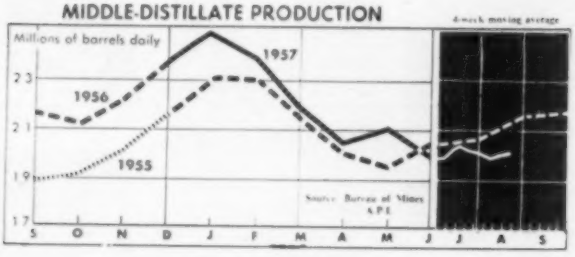
GASOLINE PRODUCTION



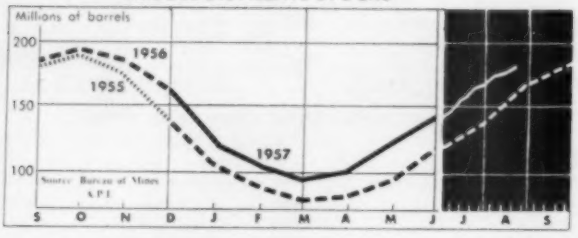
GASOLINE STOCKS



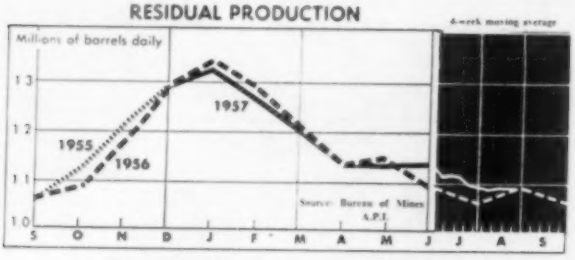
MIDDLE-DISTILLATE PRODUCTION



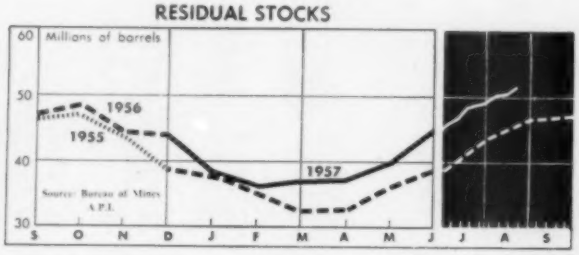
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, AUGUST 23, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production— Gaso.*	Kero.	Dist.	Resid.	Stocks‡— Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, August 1956— Daily avg. runs	Daily average production— Gaso.*	Kero.	Dist.	Resid.
East Coast	1,300	541.2	26.8	320.0	260.0	41,356	13,482	55,088	13,456	1,140	492.1	32.6	320.6	181.1
Appalachian:														
District 1	96	44.4	3.6	21.7	6.6	4,325	588	3,069	511	99	38.0	3.3	23.9	5.2
District 2	52	29.6	0.6	7.0	7.4	2,408	612	758	193	106	51.7	4.9	17.1	12.6
Ind., Ill., Ky.	1,285	668.7	38.8	273.9	123.7	29,360	6,575	21,422	5,024	1,407	739.5	72.6	286.2	150.2
Minn., Wis., Dak.	102	49.7	8.9	25.1	8.4	5,446	1,533	7,382	496	70	34.8	6.2	19.3	3.8
Okla., Kans., Mo.	733	406.4	18.0	160.4	27.9	13,779	1,786	13,543	1,058	703	375.5	15.4	167.3	29.8
Inland Texas	306	225.6	8.6	58.7	23.0	6,711	468	2,465	1,895	274	202.2	5.9	52.7	25.1
Texas Gulf Coast	1,914	987.9	99.8	516.2	237.6	23,244	3,108	17,841	8,105	1,966	948.9	111.7	498.2	241.1
La. Gulf Coast	634	344.6	28.8	160.9	34.1	9,884	3,201	7,178	1,361	714	361.2	47.9	196.3	55.1
N. La. and Ark.	88	28.4	4.6	16.6	6.1	3,856	1,129	1,854	173	103	38.0	5.0	24.2	6.9
Rocky Mountain:														
New Mexico	24	13.0	0.7	5.1	2.6	409	9	114	76	26	13.5	0.2	5.1	3.4
Other Rocky Mtn.	286	140.0	2.6	60.7	40.3	5,598	312	3,300	905	281	129.8	3.7	61.4	33.5
West Coast	1,150	520.4	4.6	146.1	324.2	25,521	416	15,657	18,984	1,106	497.1	4.0	166.7	343.3
Aug. 23, 1957	7,970	3,999.9	246.4	1,772.4	1,101.9	171,897	33,219	149,671	52,237	7,995	3,922.3	313.4	1,839.0	1,091.1
Aug. 16, 1957	7,969	3,894.4	264.6	1,775.0	1,120.4	172,136	33,021	146,703	50,923	.....	.....	.....	.....	.....
Aug. 24, 1956	7,943	3,931.9	287.0	1,859.1	1,118.7	175,816	31,521	134,381	46,069	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.50-11.75
Premium (98 octane)	14.25-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California (rack):	
Regular (88 octane)	12.9
Premium (96 octane)	14.9
Premium (98 octane)	15.4
Caribbean area (cargoes):	
Regular (87 octane)	10.875
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.0
Breckenridge:	
Grade 26-70	3.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-10.00
Diesel oil (58 d.i. and above)	9.125-9.75
Distillate No. 1	9.125-9.75
Distillate No. 2	8.50-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	8.75-9.50
Distillate No. 2	8.75-9.50
New York Harbor (barges):	
Kerosine 41-43	10.75
Distillate No. 2	10.25
Diesel fuel, 48-52 d.i.	10.55
Caribbean area (cargoes):	
Distillate No. 2	9.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.85-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.50-2.75
New York Harbor (barges):	
Bunker C fuel	$2.95
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.85-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67	....	....	....	
15-15.9	2.71	....	....	....	$1.89
16-16.9	2.74	....	....	....	1.94
17-17.9	2.78	....	....	....	1.99
18-18.9	2.82	....	....	....	2.04
19-19.9	2.85	....	....	....	2.09
20-20.9	2.89	$2.75	....	$2.62	2.14
21-21.9	2.93	2.77	....	2.64	2.19
22-22.9	2.97	2.79	....	2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, July 26, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.65
Middle District	4.47
Southwest Pennsylvania	4.18
West Virginia	4.00
Buckeye Grade	4.00
Zanesville Grade	3.04
Illinois Basin	3.15
Canada:	
Leduc-Woodbend	2.78
Redwater (Alta.)	2.67
Smiley (Sask.)	2.44
Pembina	2.65

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 36.0°-36.9°, Fao	2.00
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

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★ Carib.-U.S.N.H., dirty (USMC—55%)	1.22

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PETROLEUM ENGINEERS with up to three years experience wanted by major oil company for reserve and valuation work. Permanent Tulsa location with opportunity for advancement. Replies should furnish complete personal data, education, experience and salary requirements. Box K-313, The Oil and Gas Journal, Tulsa, Oklahoma.

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INSTRUMENT MECHANIC, ten years experience on all types refinery instruments, sober, not afraid of work, wants chance to advance. Good references. Box K-325, The Oil and Gas Journal, Tulsa, Oklahoma.

SCOUT-LANDMAN, Age 35, degree, 7 years major experience Four-Corners, Gulf Coast, Permian Basin. Desire position aggressive small company or independent preferably Four Corners or Rocky Mountain area. Box K-320, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PET. ENGR. 31, seven years experience in drilling, production, workover. Louisiana and Texas. Desires position with aggressive independent. Excellent references furnished on request. Box K-321, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST: Six years extensive exploratory experience in Mid-Continent and Illinois Basin. Diversified background in development and evaluation. Desires to locate Gulf Coast with progressive independent. Resume on request. Box K-309, The Oil and Gas Journal, Tulsa, Oklahoma

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OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas-structure. Am fee landowner of over 2000 acres. Write quickly to: Jefferson G. Smith, 215 Littlefield Building, Austin 15, Texas.

OIL LEASES IN BOOMING

4-Corners Area. November Indian Lease sale brought 30 Million Dollars. Some leases sold for $3,200 per acre. Wells estimated up to 1500 barrels of oil per day. Oil Leases from $2.25 an acre. Fortunes being made. Write for free information now. **ATLAS OIL SURVEY, Dept. OJ-7, Colorado Bldg., Denver 2, Colo.**

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WANTED—productive shallow acreage to drill. Box K-316, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Oil Royalty, Gas Royalty, and working interests Texas, Oklahoma. A'Mell Oil Properties, 1201 Elm, Dallas, Texas. RIverside 1-9251.

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SOHIO PETROLEUM Company, Operator, solicits offers to buy its working interest in the Sallyards Water Flood, Butler County, Kansas. Total Gross production from Bartlesville Sand was 2,220 barrels in July 1957. Average depth wells—2550 feet, 18 producing, 18 water input, water system and electric system. The other working interest owners have indicated they may be willing to sell their interest. For inspection and complete specifications contact: Sohio Petroleum Company, Box 9637, Oklahoma City, Oklahoma. Attention: J. E. Buckley. Phone VIctor 3-1544.

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties from acquisition to production. No properties too small, none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire or call collect for further information.

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WANTED
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Independent group is interested in purchasing one to three million cubic feet per day of casinghead or flare gas for compressor and/or plant processing facilities. Resources, equipment and personnel available to undertake project immediately on proof of satisfactory reserves. Would consider some partnership or joint owner arrangement. Might also consider purchase of operating property. Prefer Southern Oklahoma, Texas or Louisiana properties. Reply

Box K-327,
The Oil and Gas Journal,
Tulsa, Oklahoma.

Deep-Water Barge Canceled

HOUSTON.—Brewster-Bartle Offshore Co., formed early this year by two leading marine drilling companies, has canceled its order for a deep-water drilling barge.

The proposed vessel, designed to operate in more than 80 ft. of water, was modeled after the Kermac 46 owned by Kerr-McGee Oil Industries, Inc. Cancellation of the order was attributed to delays in delivery of heavy plate steel.

Company plans now call for a greater emphasis on exploration for its own account on offshore farmouts. Later, the company may acquire other offshore drilling equipment.

"In addition," a company spokesman announced, "consideration is being given to operating in other countries."

Brewster-Bartle Offshore is owned jointly by Kerr-McGee and Brewster-Bartle Drilling Co.

LEGAL

NOTICE TO BIDDERS
OFFSHORE OIL AND GAS LEASES

The Commonwealth of Pennsylvania, Department of Forests and Waters, Harrisburg, Pennsylvania, will receive sealed bids for Petroleum and Natural Gas leases until 2:00 p.m., E.D.S.T., September 24, 1957 at Room 512, Education Building, Harrisburg, Pennsylvania, which will be publicly opened and read at that time, for the leasing of certain offshore lands in Lake Erie. The Blocks are more particularly described as follows:

BLOCK 1: All that portion of Pennsylvania's offshore waters in Lake Erie bounded on the North by latitude 42° 05' North; on the East by longitude 80° 25' West; on the South by a line parallel to the Lake shore and one-half mile therefrom; and on the West by the Ohio-Pennsylvania boundary. Extreme care shall be used in drilling within three miles of the shore to protect fish breeding grounds. Containing approximately 19,130 acres.

BLOCK 2: All that portion of Pennsylvania's offshore waters in Lake Erie bounded on the North by latitude 42° 20' North; on the East by longitude 79° 50' West; on the South by latitude 42° 15' North; and on the West by longitude 79° 55' West. Extreme care shall be used in drilling within three miles of the shore to protect fish breeding grounds. Containing approximately 16,580 acres.

The Commonwealth is considered to be the owner of these Oil and Gas rights but makes no warranty as to the presence of Oil or Gas nor as to its ownership thereof and bidders assume the risk of proving title.

Forms of the required bid proposal, the lease agreement and maps showing the areas may be obtained by contacting The Division of Minerals, Department of Forests and Waters, Education Building, Harrisburg, Pennsylvania.

All bids must be submitted in sealed envelopes to the above address and be marked on the envelope "Bid for Oil and Gas Lease, Block 1 or 2."

A certified check, bank cashier's or trust company treasurer's check in the amount of $2,500.00 must accompany each bid for each tract as a guarantee of the bid. The proceeds of the bid check shall be retained by the Commonwealth and considered as liquidated damages if any bidder shall fail to execute a lease tendered by the Commonwealth. Checks will be returned to the unsuccessful bidder upon full execution of the lease.

The Department reserves the right to reject any and all bids and to waive any informalities, defects or irregularities in the bids.

MAURICE K. GODDARD
Secretary of Forests and Waters

THOMAS D. McBRIDE
Attorney General.

ADVERTISERS IN THIS ISSUE

ACF Industries, Incorporated, Valve Division 54
Alco Products, Inc. 64
Aldrich Pump Company, The 49
Allis-Chalmers Mfg. Co. 150
American Chain & Cable Company, Inc.
American Chain Division 238
Hazard Wire Rope Division 221
Ampco Metal, Inc. 205
Anchor Petroleum Company 82
Ansul Chemical Co. 211
Armco Drainage & Metal Products, Inc. 182
Armstrong Machine Works 27
Axelson Manufacturing Company, A Division of U. S. Industries, Inc. 194, 195
Aztec Manufacturing Co. 9
Babcock & Wilcox Company—Tubular Products Division, The 136
Baird Mfg. Co. 228
Baker Oil Tools, Inc. 80
Bank of The Southwest 135
Barco Manufacturing Company 77
Beacon Petroleum Company 1
Bethlehem Supply Co. 73
Black, Sivalls & Bryson, Inc. 16
Blount-Tears, Inc. 165
Bonney Forge & Tool Works 70
Bridgeport Brass Company 182
Bucyrus-Erie 166
Cable Engineering 228
Central Scientific Company 18
Chain Belt Co. 46
Chemical Industrial Corp., The 33
Chiksan Company 47
Clark Bros. Co., One of the Dresser Industries 40, 41
Classified Advertising 252, 253, 254, 255, 256
Clyde Iron Works, Inc. 140
Coates Field Service, Inc. 167
Continental-Emsco Company 184 through 191
Continental Wire Corporation 25
Cooper-Bessemer Corp., The 126, 127
Coors Porcelain Company 148, 149
Crose Manufacturing Co., Inc., M. J. 169
Darling Valve and Mfg. Co. 45
Davison Chemical Company Division of W. R. Grace & Co. 71
Dean Hill Pump Company 172
Delta Tank Manufacturing Company, Inc. 55
Dicalite Division Great Lakes Carbon Corporation 230
Dow Chemical Company, The 7
Dow Corning Corporation 15
Dowell Incorporated 97, 131
Drilling & Service, Inc. 232
Eaton Manufacturing Company, Axle Division 51
Ehrsam & Sons Mfg. Co., The J. B. 26
E-I-M Company Incorporated 147
First City National Bank of Houston 237
First National Bank & Trust Co. of Tulsa, The 229
Fleet-Line Co. 167
Flint Steel Corporation 170
Floridin Company 196
Fluor Products Company, A Division of The Fluor Corporation, Ltd. Inside Front Cover
Fort Worth National Bank, The 226
Foster Wheeler Corporation 8
Foxboro Company, The 36, 37
Fuller Company 14
Gaso Pump & Burner Mfg. Co. 44
Gates Rubber Co., The 214
General American Transportation Corporation 123
General Electric Company—Computer Department 239
Glitsch & Sons, Inc., Fritz W. 74
Goodyear Tire & Rubber Company, The 11
Grancell, I. H. 180
Graver Tank & Mfg. Co., Inc. 10
Griscom-Russell Co., The 57, 58
Guiberson Corporation 59
Halliburton Oil Well Cementing Co.— 28, 29, 181, 202, 203
Hammond Iron Works 48
Hazard Wire Rope Division of American Chain & Cable Co., Inc. 221
Hercules Tool Company 182
Houdry Process Corporation 161
Huey & Co., S. E. 167
Hughes Tool Co. Back Cover
Inferno Co., The 180
Ingersoll-Rand 242
International Nickel Company, Inc., The 200
Jones & Laughlin Supply Division 61
Kaiser Steel Corporation 175
Kennametal, Inc. 236
Kidde & Company, Inc., Walter 19
Klemp Metal Grating Corporation 173
Kuhns Brothers Co., The 69
Layne & Bowler, Inc. 63
Lucey Products Corporation 229
Lunkenheimer Co., The 35
M & V Tank Company 198
Mack Iron Works Company, The 182
Macwhyte Co. 5
Manning, Maxwell & Moore, Inc. 66, 193, 235
Master Tank & Welding 198
Mayo Hotel, The 183
McDonough Machine Service 183
Midwest Piping Company, Inc. 39
Minnesota Mining and Mfg. Co. 171
Mission Mfg. Company 240, 241
Moorlane Company 213
Murray Iron Works Company 179
National Airoil Burner Co., The 204
National Aluminate Corp. 93
National Bank of Commerce, The 68
National Bank of Tulsa 231
National Foam System, Inc. 208
National Supply Co., The 21, 22, 23, 24
National Tank Company 258
Nordstrom Valve Division, Rockwell Manufacturing Company 30
Norris Manufacturer, Inc., W. C. 4
Ohio Injector Company 50
Oil Well Supply Division 6
Oklahoman and Times 206
Olin Mathieson Chemical Corporation, Industrial Chemicals Division 199
Paris Distributor, Inc., Henry H. 227
Parkersburg Rig & Reel Co. 105
Parsons Company, The Ralph M. 31
Peerless Pump Division of Food Machinery & Chemical Corporation 75
Perfect Circle Corporation 32
Petreco A Division of Petrolite Corporation 38
Petro-Chem Development Co., Inc. 76
Porter Company, Inc., H. K. W-S Fittings Division 177
Powell Valves 52
Pritchard & Co., J. F. 53
Procon Incorporated 67
Puget Sound Fabricators, Inc. 233
Raybestos-Manhattan, Inc., Packing Div. 223
Refinery Engineering Company 60
Refinery Supply Co., The 222
Republic Rubber Division of Lee Rubber & Tire Corp. 225
Ross-Martin Co. 183
Southwestern Engineering Company 78
Sun Shipbuilding & Dry Dock Company 20
Tennessee Corporation 201
Texas Employers Insurance Association 17
Texas National Bank of Houston 234
Thompson Pump Company 206
Tretolite Company, A Division of Petrolite Corporation 65
Union Switch & Signal Division of Westinghouse Air Brake Company 56
United States Borax & Chemical Corporation, Pacific Coast Borax Division 168
United States Steel Corporation—Oil Well Supply Division 5
Universal Oil Products Co. 12, 13, 62
Valdura Paint Division American-Marietta Co. 72
Vapor Recovery Systems Co., The 207
Viking Pump Co. 234
Vogt Machine Co., Henry 42
Wall Colmonoy Corporation 233
Well Equipment Mfg. Corp. 43
Western Supply Company 34
Williams & Co., J. H. 176
W-K-M Manufacturing Company, Inc., A Subsidiary of ACF Industries Incorporated 54
W-S Fittings Division H. K. Porter Company, Inc. 177
York Co., Inc., Otto H. 72
Youngstown Sheet and Tube Company Inside Back Cover

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